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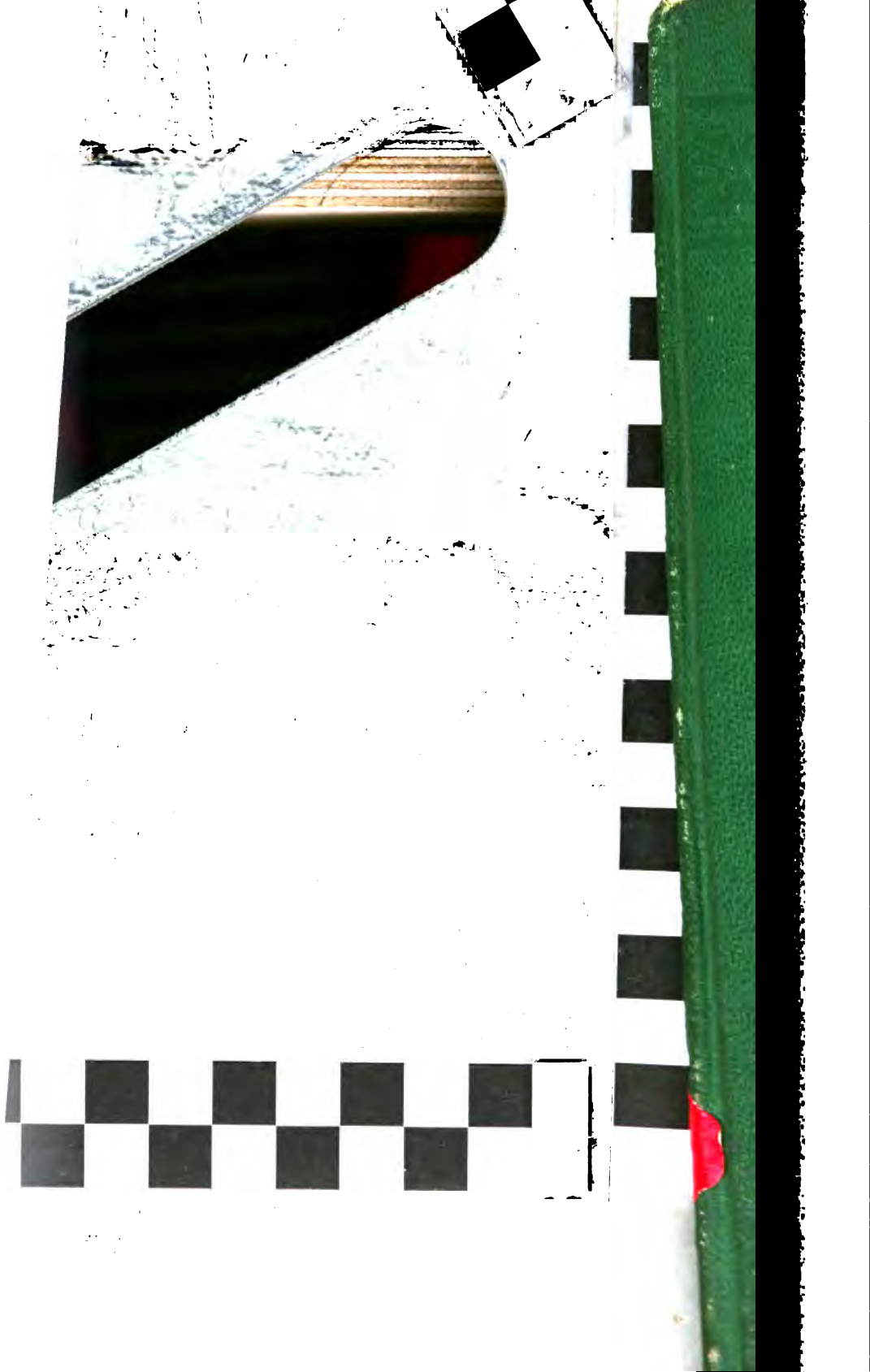


COMPLIMENTS OF

GEORGE O'NEIL.

Member of Assembly,

1888.





SECOND ANNUAL REPORT
OF THE
FOREST COMMISSION

OF THE
STATE OF NEW YORK,

For the Year 1886.

PREPARED BY THE SECRETARY.

TRANSMITTED TO THE LEGISLATURE APRIL 13TH, 1887.

ALBANY:
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1887.

May 2, 1930.

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STATE OF NEW YORK.

No. 104.

IN ASSEMBLY,

APRIL 13, 1887.

SECOND ANNUAL REPORT OF THE FOREST COMMISSION.

STATE OF NEW YORK:

BUREAU OF THE FOREST COMMISSION, }
ALBANY, *April 13, 1887.* }

HON. JAMES W. HUSTED,

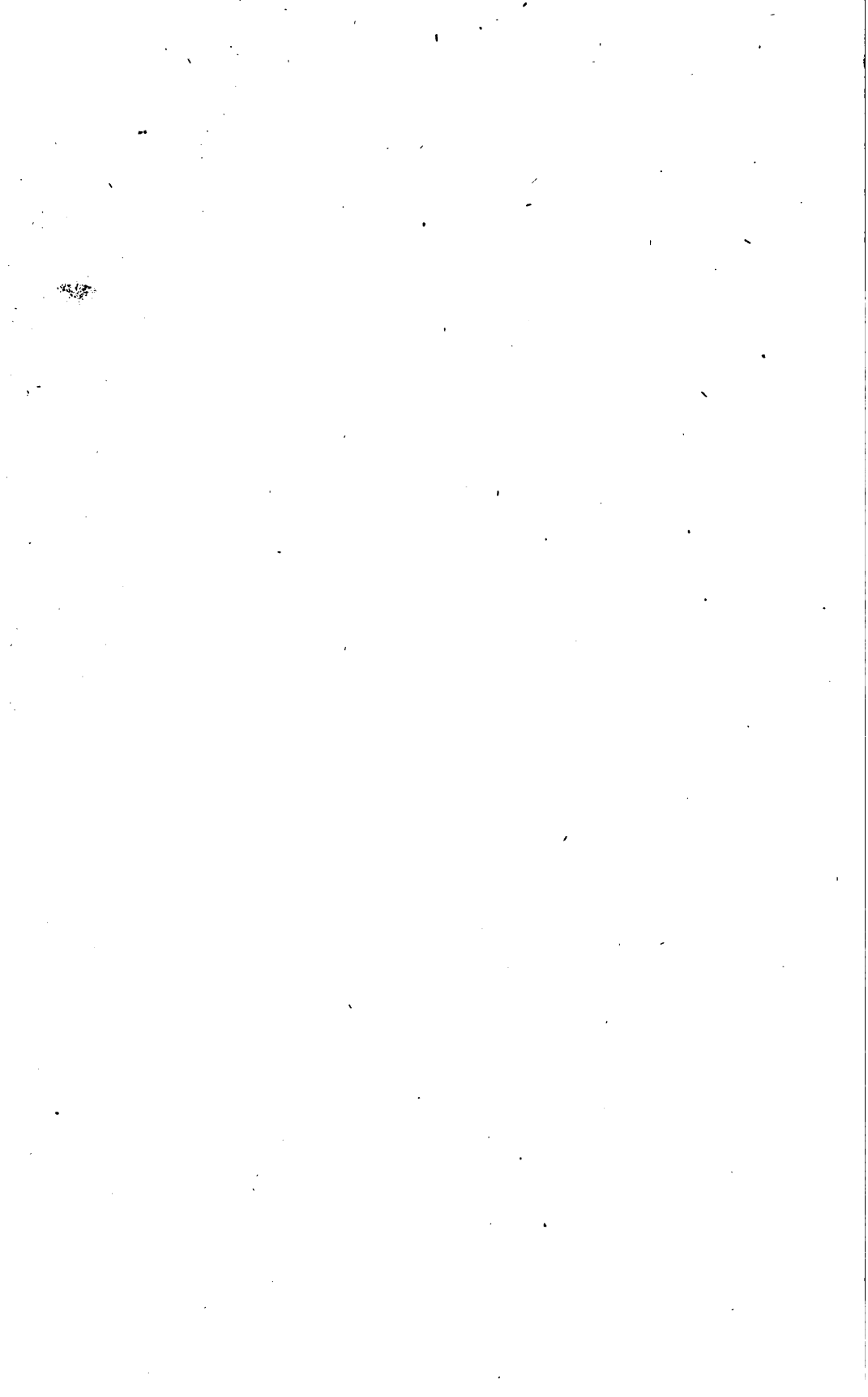
Speaker of the Assembly.

SIR: We have the honor to transmit to the Legislature, herewith, the second annual report of this Commission as indicated in the preliminary report of January 31st.

Very respectfully yours,

TOWNSEND COX,
SHERMAN W. KNEVALS,
THEODORE B. BASSELIN,

Commissioners.



PREFATORY NOTE.

To the Forest Commissioners :

* GENTLEMEN: In preparing the second annual report of the Forest Commission I have endeavored to present a plain, succinct statement of the work of the Commission from its appointment to the present time, with a brief sketch of the forestry movement in this State. In view of the short time that the Commission has been in existence, and of the fact that it has had no funds which could be devoted to making original investigations, scientific or practical experiments, surveys, etc., it could not be expected that its report should embody such information as could only be obtained by the employment of such means. In lieu of this I have presented a brief compilation of the thoughts and conclusions of the best writers and investigators of our time, in reference to the subject of forestry, coupled with a statement of authenticated facts bearing on that topic, with the hope of attracting public attention more directly to, and of enlisting the aid of the people more earnestly in the important effort to maintain the remnant of the forest area still left to them.

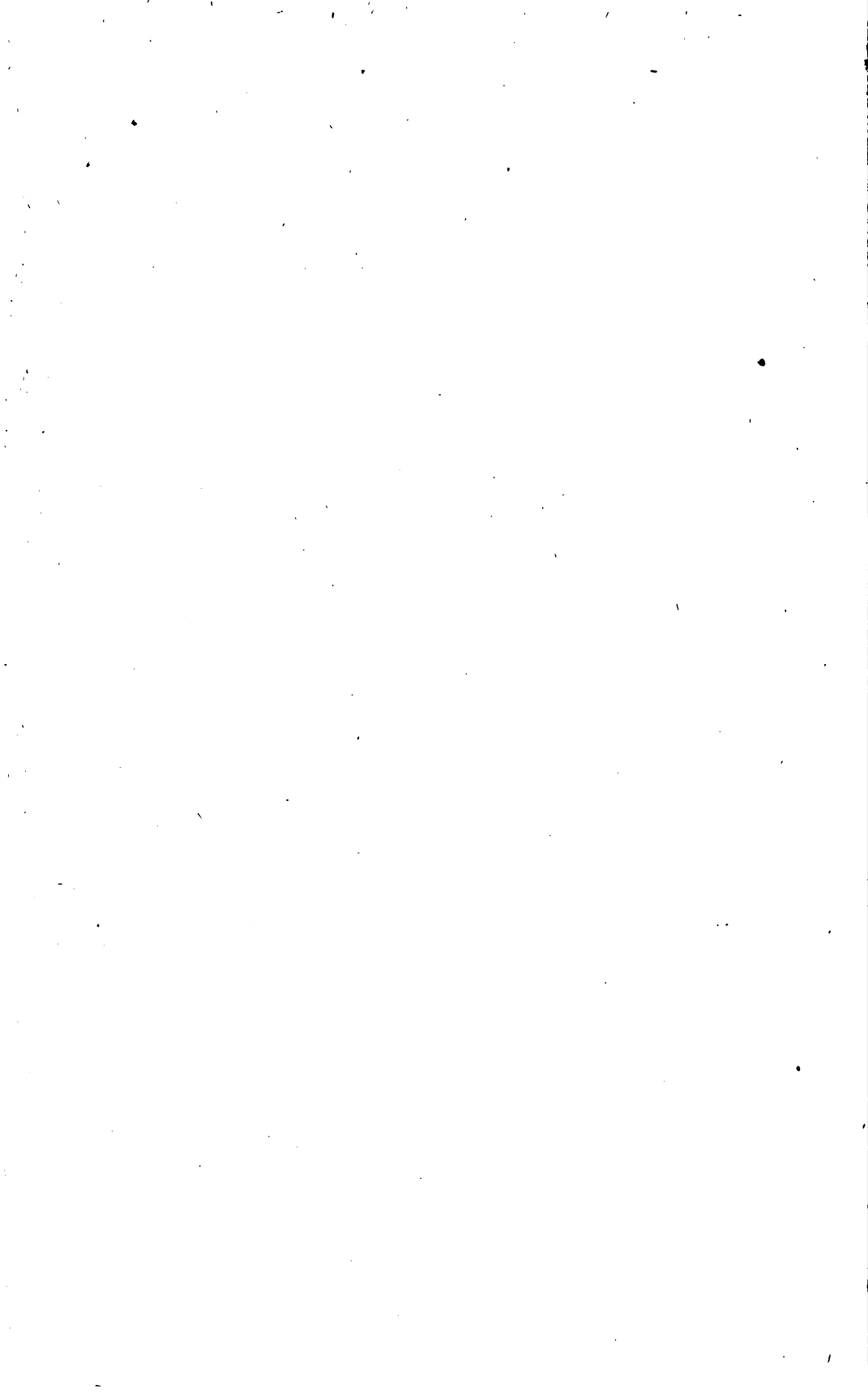
In making this compilation I have been much assisted by the labors of the late Dr. Franklin B. Hough, to whose zeal and foresighted efforts on behalf of the forests the State is greatly indebted. I am also under obligations to Mr. B. E. Fernow, Chief of the United States Forestry Division; Mr. James Hall, the State geologist; Mr. J. A. Lintner, State entomologist; Mr. B. Fernow, of the State Library, and to many others. The admirable papers read before the meetings of the American Forestry Congress have also been a source of much aid.

Very respectfully yours,

ABNER LEAVENWORTH TRAIN,

Secretary of the Commission.

ALBANY, N. Y., April 7, 1887.



REPORT.

THE WORK OF THE YEAR AND ITS RESULTS.

The initial life of all institutions of this character is involved in much drudgery and its development necessarily slow. There must be at the outset a general scheme, or working plan laid down, under which such institution is to be ushered into existence. Something is to be made to live which heretofore has had no being. To effect this there should be much deliberation and discussion of the ends to be attained and of the interests of the public, as well as of individuals, that are likely to be involved during the progress of the work. The selection must be made of proper men to fill the various posts of duty; the work to be done must be mapped out and assigned to each, and a general organization of the forces must be effected. There are to be collected all the materials, records, facts, statistics and information of all sorts, that are to form the basis of future efforts. It, as must be acknowledged, all this demands an expenditure of much time and painstaking effort to set in motion the wheels of an ordinary organization, the general scope and principles involved in which are known and understood, how much more is this true where the subject to be dealt with is a new one, little understood by any body, and when what knowledge soever may exist in relation thereto is theoretical, and little or nothing can be found of a practical nature to afford a precedent, or to act as a guide. Of this latter character is the task given to the Forest Commission. The science of forestry in America is yet in its swaddling clothes—it is, perhaps, a risk to assume that its toilet is so far made as that. Even the practical business matters that have been presented to the Commission for investigation and settlement (and which, indeed, could claim little direct connection with forestry in its legitimate sense) involved substantially new questions, demanded much investigation, were beclouded with much loosely woven legislation, and were often entangled in such contradictory enactments, opinions, discussions and rulings as to render it difficult to find a clue out of the labyrinth.

DEALING WITH TIMBER THIEVES AND TRESPASSERS.

During the past year the obligation of dealing with the class of people above designated has, of necessity, largely engrossed the thoughts and time of the Commissioners, making serious demands on both, not, however, without what must be regarded as very satisfactory consequences.

The efforts of the Commission have been rewarded (omitting mention here of other advantages gained) by two prominent results, viz.:

First. The payment into the State treasury of moneys received for trespasses, and for timber illegally cut upon State lands, the sum of \$14,057.09.

Second. The complete arrest, which promises to be a permanent stoppage, of all trespassing, timber thieving and depredations of all sorts on State lands. During the coming year it is probable that there may be some petty thieving and small acts of an illegal character committed, but the Commission has the best reasons for regarding all organized plundering operations and consequential spoliations as ended, for so long, at least, as a Commission is in existence of whom evil-doers stand in fear.

The most that, at the beginning, was expected from the Commission by its most ardent friends was that it should accomplish the second result before mentioned in perhaps one or two years. There was no expectation of recovering for the State compensation for its previous losses. That the Commission should have reached both results so early in its career is a cause for congratulation.

In addition, as a third result of the work of the Commission, is the suppression of forest fires during the year. This subject is treated in detail, under its proper head in the following pages.

At the very threshold of their work the Commissioners were confronted with the complicated and disagreeable duty of dealing peremptorily with those men who have long been in the habit of preying upon the lands of the Forest Preserve, and whose depredations have worked such harm in that section that they, if allowed to go on, would soon reduce the entire tract to waste and worthlessness. The whole subject presented many problems — problems of law, of equity and of policy. It was, however, absolutely necessary to meet and solve them. These ruinous operations must be stopped if the State were to have any Forest Preserve to preserve. This work was

an essential antecedent to any other work or plans which were contemplated for the future. To ascertain with certainty who were the guilty ones, to secure sufficient proof to warrant the Commission in proceeding against them, to obtain witnesses who dared, or were willing to give the information in their possession, was always extremely difficult, and sometimes impossible. As large and important as this branch of their work seemed to the Commissioners at the outset, it increased in dimensions day by day until it, in connection with all the difficulties and perplexities which environed it, assumed surprising magnitude. The results above named have been accomplished by the unwearied pursuit of trespassers, collections being made by negotiation when possible, but in many instances only through legal actions. (See tabulated statement of trespass cases, Appendix C.)

WORKING UNDER DIFFICULTIES.

Although this is technically styled a second annual report, it properly covers the first actual year's work of the Commission. Created by the Act of May 15, 1885, it was not completed by appointment until the middle of the following September, and its life really dates from the 1st of February, 1886, under the second section of the Act by which the Commission was established. At first, and for a long period after its nominal existence, the Commission had no office or place of business assigned to it, and consequently had no clerical help, office furnishings, or other such material aid as is ordinarily regarded as necessary for the transaction of business. Holding their meetings at their own places of business, or in the rooms of some hotel, the Commissioners endeavored to do what they could in the prosecution of the work before them. It was not until April, 1886, that they were permitted to occupy a suitable room in the Capitol, which, though of insufficient capacity now to meet their growing needs, has served a temporary purpose. That room was very scantily furnished and entirely void of those "modern conveniences," which are so lavishly supplied to other apartments of the Capitol. It was not easy to carry on an important work under such circumstances, and all progress was retarded. Even now the Commission has no room for its private meetings, being obliged at times to avail itself of the courtesy of another department, and at times being driven to occupy a room at a hotel.

The records, correspondence, surveys, field notes and all data and material of every sort that were required in daily office work were scattered throughout other departments, often filed away in inaccessible places, and it became necessary to collect them. This involved much time and work, especially in re-drafting old maps and surveys and in copying field notes and other necessary documents. The offices of the Comptroller, State Engineer and the Secretary of State have been ransacked and ancient documents brought forth and copied. Such records were found to be a matter of absolute necessity in discovering and identifying lot lines. The want of accurate surveys and the disappearance of the marks of old surveys has been a source of great hinderance and perplexity in hunting down trespassers. Boundary lines often cannot be definitely established, and the uncertainty of boundaries is a perpetual city of refuge to evil-doers. Warden Garmon has encountered this difficulty again and again. He reports: "In view of the neglect of the State to mark its lines and corners it has been difficult in many cases to prove a willful trespass, and persons who have cut over the lines have boldly asked, 'Where is your line?' and 'Why is it not marked?' In fact many parties, anxious to avoid an unintentional trespass, are to-day engaged in running out the State lines at their own expense." Such maps and charts as are obtainable are often grossly inaccurate, disagreeing and conflicting with each other. Before legal steps could be taken in trespass cases it has been frequently necessary to employ a surveyor to run the lines. Inspector Carpenter says in his annual report to this Commission: "Many inaccuracies in existing maps have been corrected and a constant endeavor has been made to exhibit the lands of the State as they lie on the ground, both in relation to natural features and to each other, giving to each plot of ground its correct topographical position and showing it correctly in shape and magnitude. The State in past years has expended large sums of money with the view of correctly locating its lands according to the original surveys and of furnishing a correct map, drawn to such a scale that individual lots are plainly shown. That this has never been accomplished those best know who have had occasion to investigate the matter." It is probably safe to estimate that two-thirds of the expense attending the settlement of trespass cases is incurred in the necessary re-surveys and the establishment of lot lines. The diffi-

culties attending this work are shown in the report of Inspector Carpenter, who says: "Many examinations of State lots have been made during the past season, but in every case it required an expert to locate the corners or lines. Such expert was either some local surveyor or other person who had long been a resident of the vicinity and had either discovered and followed out the lines himself, or was familiar with the traditional location of the lines and corners which had been handed down with other matters of local importance. The method of marking lines, time-honored though it may be, is not a perfect one by any means. There existed a practice among the surveyors of the last and the early part of the present centuries, when most of the surveys and allotments of these vast tracts of public lands or private grants were made, which was to mark a tree for a corner, whether it stood on a corner or not. If not, the true corner was marked by a stake (the perished monument of an hundred years ago) and a tree near at hand was marked for the corner. This is all very well when it is recorded in the original field notes and they have been preserved, but this, unfortunately, is not always the case, and it is liable to lead, and does lead, to litigation and serious complication. The line between the corners was originally marked by blazing the trees both on the true line and on trees each side of the line. As time goes on the marked trees mature, die and rot down, and the line they help to mark is broken in many places; gradually the whole line becomes obliterated in all but a few scattered trees, and retracing involves an expensive delay in hunting up and securing the services of some local surveyor, who may slowly pick up the line from point to point, reblazing the trees as his predecessors had done. Corners have been frequently marked by 'scoring' the lot numbers on the sides of the trees facing the lot to which they belong, or 'straddle marked,' as one ancient author called it. Such marks were found on trees in many localities during last summer, all denoting signs of extreme age."

These State lands cannot be examined with any degree of certainty until the lot lines are fairly and plainly indicated, and while this is being done, the corners can be permanently marked. It is too expensive for the State to undertake it piecemeal, as has been done formerly, by hiring local surveyors, at from five to eight dollars a day and expenses. From supervisors and assessors in all parts of

the State where there are State lands comes a general demand for a re survey. "It is impossible to describe lands correctly on the tax list, or to tell whether State lands are being cut over by lumbermen unless they are resurveyed," is the burden of many letters received by the Commission.

In the work here indicated and also in searching assessment-rolls, scrutinizing tax lists and similar researches, a necessary preliminary to the present as well as to the future work of the Commission, the clerical force of the office has devoted all the time that could be spared from regular office work, the volume of which is steadily increasing. Taking it all in all the Commissioners feel that during the past year they have labored under disabilities and against obstacles which they hope and expect will largely be removed during the year upon which they have now entered.

FOREST FIRES.

Another threatening agent in the destruction of forests, as is well known, is fire. Facts and statistics on this subject have been so often and widely circulated, and the causes, treatment and methods adopted for the prevention of forest fires have been so fully discussed as to render any repetition unnecessary here.

While for the past year fires have raged with destructive fury through the forests of other sections of the country, entailing immense losses upon both States and individuals, the people of New York are to be congratulated that their forest lands have been spared. No fires of any importance have occurred in the forests of this State during the past year, and the few that have broken out have been speedily extinguished and inconsequential in their results. To provide against a constant recurrence of destructive forest fires was one of the first duties which the Commission undertook. It being provided by the act that one or more firewardens should be appointed by the Commission in each of the 234 towns in the Forest Preserve, an effort was early made to procure the names of suitable men to act in that capacity. It has not been easy to find so large a number of satisfactory men, owing to difficulties that will readily suggest themselves. Still the Commission has been as successful as could be anticipated in this respect and the force that has been appointed has proved capable and efficient wherever any service has been called for. Upon firewardens is devolved the special duties of taking such pre-

cautions against the happening of fires as the Commission may direct, and of extinguishing such fires as may occur. Under the provisions of the act, firewardens are paid two dollars a day for their services during the time they are actually employed, and bills for their services must be paid by their respective towns.

In towns not included in the Forest Preserve the supervisors are the legally constituted firewardens. Rules have been established prohibiting the lighting of fires except for especial purposes, giving minute directions for building such fires as may be necessary, and directing how they shall be guarded and extinguished.

Careless smokers and sportsmen are held responsible, under the rules, for damage caused by fires which they may originate. The rules are printed in various forms and are distributed and posted fully throughout the Forest Preserve, by the foresters and firewardens. In addition to these rules there is issued to each firewarden, when appointed, a full and detailed letter of instructions defining distinctly the duties of his position and giving minute directions as to his methods of procedure in case of the occurrence of a fire.

The Forest Act also prescribes minutely the various precautionary measures that must be adopted by railway companies whose roads pass through or near forest lands. The attention of the railway companies was at once directed to these enactments and the warden reports that they have complied therewith with satisfactory results. The efforts of the Commission have been precautionary, tending to the prevention of fires, coupled with the establishment of what seemed to be sufficient measures for extinguishing fires whenever they are once lighted. In this case, as in all others, the principle that prevention is better than cure holds good. It is regarded as due to the means employed that there have been no fires during the past year, in any part of the Forest Preserve, that have done any damage of consequence or that call for comment.

DEATH OF TREES — INSECT RAVAGES.

It is a well known fact that in some parts of the forest preserve large numbers of trees, especially spruce, have perished within a few years past. This has been attributed to a variety of causes, chief among which are insects, drought and over-maturity, or old age. Testimony gathered by the Commission goes to show that insects have been less destructive during the past two years than in

some preceding years, though they are still at work, and in some places have done much harm. From one or other of the above causes, doubtless, or a combination of all, there has been a great mortality among the spruce within the past ten years. A gentleman who is engaged in the lumber business, and who has had excellent facilities for observation, says that he knows one tract of 30,000 acres in the Adirondack preserve where the spruce trees have all died. The trees on this tract have been attacked by the borer beetle, but whether the borer caused their death, or attacked them after they began to perish from other causes, he is uncertain. He thinks a severe drought during two successive summers, about nine or ten years ago, was the chief cause of their dying. He also calls attention to the fact that in some parts of the forest, where the trees have been vigorous heretofore, in the spring, soon after the spruce trees have put out the young shoots, the ground under the trees has been, for several years, strewn with the fallen new shoots. After having grown out for an inch or two, they suddenly drop off. This he attributes to the destructive work of the larvæ of the borer beetles. In discussing the causes of the death of spruce trees he ranks, in the order of importance, first, maturity or death from old age; second, drought, and third, attacks from insects.

On a certain ridge running east and west, covered with a heavy growth of spruce, our notice has been called to the fact that the trees on the south side of the ridge have nearly all perished, many acres being covered with the dead trees, while on the north side the trees are healthy and vigorous. To the careful observer there seems to be no difference on the two sides of the ridge in the character of the soil, moisture or age of the trees.

Mr. C. B. Tillinghast, of Albany, writes: "As to the death of the spruce tree, I believe that follows in the wake of the devastation produced by flooding (by means of dams) and fires, both having undoubtedly been largely instrumental in denuding and wasting the soil and drying up (by exhaustion at certain seasons of the year) the smaller tributary streams. This is noticeably the case in the Fulton Chain, Hamilton county, and on the line of the Raquette river. I have been told that while spruce was once abundant in many sections of the woods, it is now mainly confined to the more remote and unmolested parts, and also that, and this I can verify

myself, where once destroyed the spruce tree seldom reappears, except on almost virgin soil."

Mr. Morton S. Parmelee, of Malone, writes to the Commission as follows: "The spruce trees are dying in strips or belts. I have studied this matter ever since 1880, when we first noticed it on this slope of the Adirondacks, and do not believe any man knows the entire secret of it. The worms certainly are in the dead tree very soon after it is dead, if they do not precede and cause the death. Some men claim that the worm girdles the tree and kills it; others think that the exceptional winters of extreme changes of heat and cold kill the timber. If this last is the case I do not understand why the decay should seem to be so uncertain and freaky, now on the top of a mountain, now in a valley, on both northern and southern slopes, on wet and dry soil, or why it should mainly be confined to the spruce, or run in belts of timber."

Mr. Isaac Kenwill, who has been a resident of the Adirondack region for the past twenty-five years, writes to the Commission from Raquette Lake, under date of March 12, 1887:

"For the past twenty-five years I have had every opportunity of watching the different changes that have taken place in regard to timber lands of this State, and I find that the greatest enemies to the spruce tree are, first and greatest, the lumberman; second, fire; and third, the beetle. I regard the lumberman as the greatest destroyer, as both the fire and the borer-beetle follow him. I will give you the reason why I think so. The great burnt districts are in every case those lands where the spruce has been partly cut off for lumber. For instance, the burnt lands of the Boreas and Indian rivers had been partly or nearly cleared of marketable spruce, and the burnt districts are the only ones where I have found that springs disappear or have shown a visible decrease in the flow of water. I can show you in the fifteenth township, Totten and Crossfield's purchase, where, before it was lumbered and burnt over, there were several springs that were never known to be dry which have now entirely disappeared. Also the ravages of the beetle, so far as they have come under my observation, are chiefly confined to the borders of the lumbered and burned districts. I had the pleasure this winter of accompanying a Canadian lumberman through several townships in this vicinity, and he spoke to me several times of the thrifty and healthy appearance of the spruce in that section

and their entire freedom from borers. At present it is a recognized fact that in all the districts between Cedar Lakes and Albany Lake, from north to south, and the outlet of the Fulton Chain of lakes on the west and the head of Long Lake to the east, the spruce timber is in a perfectly healthy condition, and also that there has been no perceptible change in the streams or springs in that locality. The only appearance of the beetle is around the margin of burnt places, and these are but few, and only of a few acres. The fires in that section have all been caused by camping parties or hunters, but in the lumbered districts they have chiefly been lighted by people who were clearing off small parcels of land for farming purposes."

Such information and opinions as are collected in the foregoing correspondence make no pretensions of a scientific character, but are valuable as being the testimony of observing, intelligent men, long familiar with the woods. Both facts and opinions gathered in this way are liable to be contradictory. Science may be able to reconcile them.

Mr. Albert N. Prentiss, professor of botany at Cornell University, does not think that forest trees in that region have been recently (say within the past eighteen years) injured by insects to any important extent. "A few trees," he says, "remnants of the old forests, have died on the university campus; but I think the want of moisture, occasioned by increased exposure and severe droughts, has been the chief cause, rather than the insect attacks, although borers have been found in the dead trunks." The trees referred to are hickories (mostly shag-barks) and black oaks.

Prof. Charles H. Peck, our State botanist, in a recent trip through Essex and Hamilton counties noticed that in two or three localities the larch trees (hackmatack) were suffering from the ravages of an insect that defoliated them. He says that he was not before aware that the death of trees was caused by this insect, but in these instances such appeared to be the fact. This insect is known as the larch tree saw-fly (*nematus erichsonii*) and has been described by Prof. Packard as very destructive.

Among the insects that make havoc among the spruce trees as recently described by Prof. Packard are the black-headed spruce bud worm (*Teras variana*). It is found on the terminal shoots of the tree, but does not, so far as observed, make any decided alteration in the appearance of the shoots. The caterpillars "usually live near

the ends of the shoots, feeding on the new leaves, and, cutting off the tender leaves, they make a passageway between them and the shoot, which they line with white silk. When disturbed they crawl out of their silken retreat and let themselves down to the ground by a silken thread. The caterpillar when fully grown is of the usual shape of a leaf roller, deep green with a dark reddish head and cervical shield."

The Red Spruce bud worm (*Gelechia obliquistrigella*) is reddish brown in color. The caterpillar is hatched in August and feeds on the trees during the autumn. The evergreen span-worm (*Thora constructa*) is a very common caterpillar on various evergreen trees. It is small, green striped with white, and so like the leaves in color as to escape ordinary observation. It is found in July and by the fifteenth of August is fully grown. The eggs of the insect are laid on the terminal twigs. The common spruce bud worm (*Tortrix funiferana*) and several other larvæ of this genus are very destructive. For killing these pests entomologists recommend the use of kerosene and buhach (made from the dried flowers of *Pyrethrum cinerariæfolium*). These remedies can be applied often successfully to ornamental trees, standing singly, or when there are few in number, but are not available for forests. No way has yet been discovered of ridding our woods from insect pests.

FORESTERS AND THEIR DUTIES.

Those who understand the science of forestry as it exists in Europe, and are familiar with the methods that obtain and the character of the foresters employed there, need not be told that at the present time it would be equally as vain to endeavor to employ the methods of European forest science for our State purposes, as it would be to try to find the ideal European educated forester in the North Woods. The entire condition of things here differs so materially from that in the old world that it would be simply impossible to make the elaborate science and intricate machinery of European forestry available at present in the State of New York.

Whether or not, however, scientifically educated foresters are needed is not a practical question. They cannot be obtained, and this fact obviates a waste of time in searching for them. In endeavoring to select men to fill the positions designated in the act as

foresters, the best and only thing for the Commission to do was to procure men, if possible, familiar with the woods and with the habits of woodsmen, familiar with the localities where their work was to be done, and especially having such knowledge of the State lands and the traditions concerning them, their location, boundaries and general character, as might be acquired by living in their vicinity, and who should also have a reputation for honesty and efficiency. As, in the case of selecting firewardens, the Commissioners could not possibly have such an extensive acquaintance throughout the fourteen counties of the Forest Preserve as to enable them to select men from a personal knowledge of their qualification, so it became necessary that they should rely largely upon the recommendations of known and trusted men throughout the different localities from which the foresters were to be chosen. To say that under these circumstances some mistakes in making selections were possible is simply to utter a truism. Exactly what was to be required of a forester was not always understood, even by those who were most ardent in the work of "preserving the forests." Many, perhaps a large majority, of those who are the most eager to "have the work go on," have the faintest possible idea as to how it is to go on, or what methods should be employed to reach the desired end, and are often equally uncertain as to what that end should be. Many applicants were pressed upon the Commission for appointment, with the best intentions doubtless, whom the Commissioners felt compelled to reject as being, in their opinion, unfit for the services required of them. But by the exercise of what discretion soever the Commissioners were enabled to command they gradually filled the roll of foresters to its maximum number.

Under the appropriation of 1886 it was necessary to reduce the number of foresters for the following year from twenty-five to fifteen — a feeble squad, numerically, considering the work there is for them to do. This small number can only, under the present limited appropriation, be paid at the rate of forty dollars a month. Out of this the forester is obliged to pay his own expenses while on duty, which are frequently considerable, as he is compelled to travel hither and thither throughout the woods in discharge of duties assigned to him.

Foresters are constituted, primarily, the legal guardians of the forest. They are on the watch for thieves, trespassers and evil-

doers of every description, having a constant care, as well, to see that all precautionary measures for the prevention of fires are duly observed and enforced. When trespasses or unlawful acts of timber cutting are discovered, it is made their duty to go at once to the locality where such unlawful acts have been committed, to make a thorough investigation of all the facts connected therewith — such as the names of the guilty parties, the exact amount of damage done, the disposition made of the logs that were cut, if any, etc., and report the same in writing to the Commission. In the investigation of trespass cases, maps of small sections of territory are prepared and, together with copies of field notes, are sent out to foresters.

Careful records of each and all of these trespasses have been kept in this department with all correspondence, court proceedings, etc., full and complete for each case. Such records show the date when the facts were first reported to this office and by whom, the name of the party cutting or carrying away the products of the forests, the number of the lot, and the tract, patent, grant or grand division of which the lot is a small subdivision, the county and town where the land is situated, the number of logs, or pieces, and the equivalent in "markets," * or standard logs, the number of trees, with the additional measurement of the bark in cases where hemlock is stolen. Wherever possible, the logs or bark are traced to the buyer, and in a large number of cases such buyers have stood behind the jobbers and have paid the State for such logs or bark. An uniform scale of prices has been adopted in such circumstances.

The Commission had twenty-five foresters in its employ at the opening of the spring of 1886. The whole territory of the eleven northern counties was at first divided into twenty-four districts, each district being so chosen that it is traversed by at least one thoroughfare. These were laid out with an idea of better protecting exposed localities rather than being an equal distribution of territory among the foresters, consequently some districts were much larger than others. A map was prepared for each district, showing plainly the State lands and such natural features as would enable foresters to

* A "marke log" in New York is a standard log thirteen feet long and nineteen inches in diameter. At least, such is its original meaning; but it is now used variably in different localities and is falling into disuse. It should be dropped altogether and foot measurement used in its stead.

readily locate the land, provided the lines of marked trees were still in a fair state of preservation. Each forester also received minutely detailed instructions regarding his duties and conduct. A different subdivision of the preserve into forester's districts has been since made, based on water-shed lines and outlets for timber.

Soon after the close of the summer season and of the reduction of the number of foresters to fifteen, the remaining force was assigned, in pairs, as far as available, to the State lands within or near their districts, with the design of obtaining an accurate description of each parcel as to timber, soil, lay of the land, streams and ponds, roads, occupancy, death of trees and the causes, and other details, as well as to familiarize them with the lands of the preserve and to keep a sharp watch on would-be trespassers. (See "Schedule of Inquiry," Appendix B.) The object of sending the foresters in pairs was for the purpose of mutual assistance and protection. Owing to severe cold, snow, ice, the frequently swollen condition of the streams, the necessity of camping out on the lots, often at a long distance from dwellings or human aid, it would have been difficult and sometimes impossible for a single man to have accomplished this work and often unsafe to have attempted it. Accompanying the schedule of inquiry was a letter of instructions as to modes of procedure.

To these instructions the foresters responded readily and have waded through deep snow and have braved severely cold weather in order to give to each parcel of land the careful examination required by the schedule. Their reports are filed in this office, and a digest of each is made and a diary kept of the operations of each forester. In addition to the above reports, each forester is required to make a weekly report of his doings. Blanks are printed for this purpose on which he accounts for himself every day of the week. This has been found necessary as a means of keeping track of, and maintaining discipline in a force necessarily widely scattered and difficult to reach by mail or telegraph.

In examining these lands the foresters report the same difficulty in finding them, owing to the absence or obscurity of the lines marked on the trees, as has already been explained. They have had to fall back on the knowledge of some local surveyor, or old inhabitant under the guidance of whom the lot corners have been, in the

majority of cases, discovered, while in some the word of the guide had to be taken in the absence of any visible marks of a corner. Maps have been prepared in each case of an assignment of territory, showing the location of the State parcels, and such natural features as would enable the foresters to partially identify the localities sought, each map being accompanied with a copy of the field notes of the original survey of each of the parcels, where such are on file.

The reports serve as a basis of readily computing the value of the merchantable timber on the lands, by showing the size and character of the trees, and whether or not there are roads or streams available for getting the timber out. The method of procedure is nearly similar to that adopted by large lumber companies in ascertaining the value of timber lands, with the difference that the lumbermen send surveyors to mark out the lines before making the appraisal. This Commission has no appropriation for surveys, though the necessity for surveys is greatly felt. Owing to the large number of lots to be examined, the small number of foresters to make the examinations, and to make them, too, only in the intervals of their own duties, as well of owing to the great distances to be traversed, this most important work will necessarily take a long time in its accomplishment. Considering the accumulating and important work that will fall on foresters, necessity demands an increase of the force.

MISCELLANY.

Of all the outcome from the efforts of the Commission, the general public is doubtless most interested in the chief results already named, viz., that former trespassers have reimbursed the State on account of public property wrongfully taken; that timber thieving and spoliation of forests have been stopped, and forest fires prevented. But this, by no means, includes all that has been accomplished in laying the foundations of future work, as the foregoing pages show. The working force of the Commission was completed by the appointment of a Secretary on September 30, 1886, and the force is regarded now as well organized, or as well as the limited appropriation for the Commission will admit. Many topics connected with, and growing out of the work of the Commission—topics hitherto vaguely understood and rendered

nebulous by manifold legislation -- have been investigated, and doubtful points settled by the aid and advice of the Attorney General and the attorneys of the Commission. Prior to the passage of the act of May 15, 1885, many of the duties which, by that act, were devolved upon the Forest Commission, had been vested in the Comptroller and in the Commissioners of the Land Office. Other matters of a kindred and collateral character were distributed among still other departments of the State government. The experience of the Commission has confirmed the wisdom of the policy which would combine in one and the same department all the various powers, duties and offices that relate to wild and forest lands, and of placing the whole business under one uniform control, if the State is ever to conserve its interests in, and derive the large benefits that it ought to derive from, its forests and wild lands.

VALUE OF THE PRESERVE.

Throughout the Forest Preserve, the value of land has been recently greatly increased. That increase is still going on, and, in all human probability, will be greatly augmented within the next decade, so much so, that under the conditions of our rapidly growing population and extraordinary development it cannot be now estimated. For our present purpose it is sufficient that the land of the Forest Preserve is, and must be, a treasure which should be jealously guarded and judiciously managed. This is a dictate of ordinary business prudence. Perhaps a large portion of the general public which has looked upon these forests as mere wild lands affording a good place in which to have a summer frolic, but for little else, and has attached to them little or no pecuniary value, may not appreciate the argument drawn from this estimate of their worth, but those who have a knowledge of the matter, (and they are by no means a small class) well know that their valuation is not exaggerated here. A practical business man whose knowledge of the Adirondack lands and familiarity with the whole subject entitles his opinion to respect, recently said, "There is a regular land boom now going on in that region. A year ago lands were offered to me at three dollars an acre, with an intimation conveyed that I might get them by bidding two dollars or even one dollar and fifty cents, which are now held stiffly at five dollars or six dollars an acre, and cannot be touched at less money. They will never be worth any less and will constantly

appreciate in value, as the timber becomes exhausted in other parts of the State."

Land adjacent to the lakes and affording advantageous locations for summer residences is in great demand; islands, points, and other pleasant situations rating very high, with a rising market. For instance, a gentleman bought a point on one of the lakes, a half dozen years since, containing 160 acres, for a few hundred dollars. Though there have been no improvements made on this land the owner has had repeated offers for it within the past year or so, made on a rising scale of from \$3,000 to \$5,000. Another tract of land, favorably situated, containing 500 or 600 acres, cost about \$1,000 a few years ago. The purchaser has since expended in improvements, say \$2,500, and has recently refused to sell it for \$10,000. About five years since, a point on one of the lakes, containing only some thirty acres, not particularly desirable, was bought by a gentleman for \$300. He has recently been offered \$5,000 for it, but his price is \$6,000, and it is understood that he is about to sell it for that amount. There are no improvements on it. All this shows a surprising advance in the value of such property within the past few years. These instances by no means stand alone; there are many choice situations scattered through the Adirondack Preserve that are equally valuable.

The present and prospective worth of these lands as merchantable timber lands; the value of the Adirondack region as a resort for those who, broken in health and weak of nerve, seek its attractive hills and valleys as a "rest-cure," in which to recover their lost energies; as an immense track of natural forest that is at once a sanitarium and a paradise for pleasure seekers, wonderful in its varied scenery, accessible by railway on every side, and within a few hours' ride of our great cities whence thousands are flying in the hot summer months in search of pure air and wholesome out-of-door life; all these contribute to confer on these forest lands a value which is at present, enormous, and for the future, incalculable.

Yet the State cannot, to-day, tell how much of this land it really owns, nor define the boundaries of so much as it owns with any accuracy. It would be wise for it to have a re-survey made of its lands, and to have lines and boundaries definitely established before their area is further reduced by eager squatters and land-stealers who have for so long a time regarded the State, in this matter, at least, merely as a goose to be plucked.

RASCALLY OPERATIONS.

There has been a great deal of knavery practiced in by-gone years in connection with the redemption of lands which have been sold for taxes, and which is likely to prove a source of trouble to the Commission. Warden Garmon, who has come into more immediate contact with this form of rascality, says in his report to the Commissioners: "The State law, which provides for the cancellation of tax sales of lands once used for homestead or agricultural purposes, has been used to gain possession of land upon which any farming operation may have been carried on, no matter how slight. This has resulted in cancellations based on affidavits describing agricultural operations which never existed. Upon investigation it has been found that some of the affidavits attached to redemption papers were fraudulent in every particular. In the matter of lots 266, 267 and 272, township 10, Old Military Tract, the parties making the affidavits have been indicted for perjury by the grand jury of Franklin county, upon evidence furnished by the Forest Commission. These parties made affidavits to the fencing of lands, to crops planted and raised on ground which was shown, by conclusive proof, to have been, and to be now, original forest land."

Such bold and knavish attempts to plunder the State the Commission is attempting to stop, and, so far as possible, to redress the wrong that has been done. Owing to the vigorous measures that have been adopted by the Commission with respect to this matter, it is to be doubted whether like attempts will be made in the future; but to recover the lands that have been heretofore stolen from the State, by frauds of this character, is a more difficult task. It is almost impossible, in most cases, to obtain that legal evidence which is necessary to convict the offenders.

It is also impossible to determine, with any accuracy, or, indeed, to do more than hazard a guess as to the amount of losses that the State has suffered in past years at the hands of those who have deliberately robbed its lands of timber to fill their own pockets. A single item of information, which, by an almost accidental combination of circumstances, came to the knowledge of the Commissioners served as a hint, and only a hint, towards opening their eyes to the magnitude of this robbery. It has been shown by figures that during the years 1871 to 1876, one individual cut from State

lands 52,131, ²¹/₁₀₀ market logs, valued at the lowest estimate at more than \$52,000. He was only one of many who were engaged in this work of plunder during the same period, and was by no means the largest operator. What is true of the years before specified, is true of the succeeding years and of how many preceding years is, and must remain unknown. This was the wholesale work of plunder that, it is believed, the Commission has prevented.

LAKE GEORGE ISLANDS AND CUSTODIANS.

Much embarrassment has arisen from the question of jurisdiction over the islands in Lake George and that of the right of "custodians," so-called, who have occupied certain islands in both Lake George and some of the Adirondack lakes under color of State authority formerly given by the Commissioners of the Land Office. The term "custodian" has never been accurately defined, nor does it appear what rights the custodian gains by his appointment.

Persons so appointed have apparently supposed their appointment to confer upon them the right of permanent occupation, and, so far as it appears, acting in good faith, have expended in many cases, considerable amounts of money in the erection of summer houses and in various improvements. The subject having been referred to the Attorney-General by the Commission, he has expressed his opinion that it is by no means clear that authority ever existed for the appointment of such custodians, or that the right to build and live upon, to improve and enjoy the islands substantially in the same manner as they could have done under a lease, ever accrued to the appointees by reason of their appointment. (See opinion of Attorney-General O'Brien, Appendix A.) This condition of things is felt by the custodians to be a hardship, and it is certainly perplexing. Many applications have been made to this Commission for short leases of land, for occupation during the summer, but the forest act forbids the Commission to make leases of State lands. These applicants desire to avoid the appearance of being squatters, which character they must either assume, or abandon their summer homes and forfeit their investments. At present this Commission is powerless to afford any relief in the premises, and the attention of the Legislature is respectfully called to the subject, with the suggestion that such action be taken as will define the status of custodians, as well as that of others who are occupying State lands for pleasurable and recreative purposes.

It is submitted that it might be good policy to confer on this Commission power to lease to proper persons, small parcels of land, for brief periods, and under judicious restrictions. Such action would seem to be only justice in affording relief to those who are already occupying sites belonging to the State by a supposed right obtained from the Commissioners of the Land Office (as before explained), as well as a wise policy in securing a proper supervision over the occupation of State lands. If entrusted with the exercise of such power this Commission could more easily exclude undesirable classes from the preserve, and increase the number of another class who desire summer homes there, and who are interested in the preservation of our forests. Such occupants as the Commission has in view would lend an elevating character to the vicinity in which they lived and enhance the value of neighboring lands. This matter is assuming year by year a graver character, and is likely, in the absence of well considered legislation, to become a source of perplexity. It is earnestly hoped that the Legislature will give it serious attention and provide for the dilemma in such a manner as may seem wise and just.

ASSESSMENT-ROLLS IN THE TAXATION OF STATE LANDS.

According to chapter 280 of the Laws of 1886, wild or forest lands belonging to the State are subject to taxation, at a light valuation or rate, as similar lands of individuals are assessed and taxed. The assessors are required to file a copy of their complete roll in this office, in each year, beginning with 1886. The examination of these rolls has developed some facts, according to the inspectors' report, which are of interest. "Out of 114 towns and wards in which State lands are located, fifty-seven made attempts at an assessment. Of these, seven were rejected for non-compliance with the law. In fifty towns there were assessed 594,688 acres against the State, at a total valuation of \$569,412, which, at the rate per cent, would produce \$10,509.85." *

Out of the fourteen counties which are embraced in the Forest Preserve, eleven filed copies of their assessment-rolls with the Forest Commission, viz., Clinton, Essex, Franklin, Fulton, Hamilton, Herkimer, Lewis, St. Lawrence, Saratoga, Ulster and Warren counties. Those sending no copies were Greene, Sullivan and Washington

* See report of Comptroller for 1886.

counties. In these eleven counties, fifty-one towns filed copies of their assessment-rolls as follows: Clinton, two towns; Essex, eleven towns; Franklin, six towns; Fulton, four towns; Hamilton, eight towns (all); Herkimer, three towns; Lewis, three towns; St. Lawrence, four towns; Saratoga, three towns; Ulster, two towns; Warren, five towns. A total of fifty-one towns.

A careful examination and comparison of each of these rolls has been made and a tabulated statement completed, which shows, at a glance, the comparative assessed valuation of lands of a similar character in different localities. Such comparisons are of the utmost importance to this department, as they show the local value of the forest lands owned by the State. In order to make a complete statement, each of the 3,033 parcels, which, together, make up the forest preserve, was examined, and where not assessed, a note was made to that effect.

This critical examination of the assessment-rolls has disclosed the fact that many of the State lands are assessed to individuals as private property, and that other parcels were assessed both to individuals and to the State. Forest lands are rated from twenty cents to four dollars and sixty-two cents an acre, and, in some localities, the valuation of denuded lands is as much as that of forest lands in other places."

EXTENSION OF THE 1859 CATALOGUE OF MAPS AND FIELD NOTES.

There is no general index of the maps and field notes on file in the various departments of a later date than 1859. Since that time there have been very great accessions. Besides, new departments have been created which would naturally accumulate and preserve this class of records. In the Comptroller's office alone no less than 400 maps have been added to this collection since the publication of the above-mentioned catalogue. The new departments of the State survey and the Adirondack survey have been established, carried on for a number of years and abandoned, without giving the public any access to, or idea of, the scores of old maps, surveys, field notes and other valuable memoranda which must have accumulated during the years devoted to the enterprise. The Comptroller's office, the office of the Secretary of State, and that of the State Engineer and Surveyor, as well as the State Library, have each a valuable index carefully brought down to the present day.

There is in progress, to be taken up at odd times, an extension of the 1859 catalogue, by which it is intended to add to it, in their order, the titles of the records which have been accumulated in the several offices, including our own, since the issue of the catalogue of 1859.

RETROSPECTIVE.

During the time that the Commission has been in existence it has expended the sum of \$30,036.72. This includes the payment for much material necessary for organization that will be permanent and will involve no expense hereafter. As the Commission has paid into the State treasury \$14,057.09, there is only a balance of \$15,979.63 left to represent the pecuniary cost of the Commission to the State, surely a trifling sum when weighed against the work that has already been done and the foundations that have been laid for future accomplishment.*

The Commissioners, of course, could not have remained in ignorance of the fact that in the performance of the official duties with which they were charged they have incurred the suppressed ill-will in some cases, and in others the open hostility of those with whom they have been compelled to deal. This was to be anticipated, and it was probably unavoidable. They are conscious that they have intentionally given offense or caused injury to no man, and that in all instances they have pursued their work with none but the kindest feelings, exercising at the same time as much leniency and forbearance as was compatible with the ends of justice. While, on the one hand, they have shown no favoritism, so, on the other, have they shown no hostility and have felt none. If the laws which have controlled their action have at times caused a sting, it could not be fairly laid at the door of the Commissioners; they might regret, while they could not avoid it. Such instances doubtless exist, but it is hoped that they are few in number. On the other hand, they cannot but feel gratified at the high commendation which has been passed generally upon the course that they have pursued, and at the great interest that is everywhere felt in the work in which they are engaged.

In the prosecution of their new enterprise the Commissioners have received, throughout the past year, a most cordial assistance

* Since the above statement was made out the Commission has obtained judgment in another trespass case for \$1,250.

from other departments of the State government, which they wish to publicly recognize. In some branches of the work that has been devolved upon this bureau there have been many details that were so closely connected with the Comptroller's office that, except for the courtesy shown and aid rendered by the officials in that department, all transactions connected therewith would have been extremely difficult. Supervisors throughout the State have cheerfully co-operated with the Commission in discharging such obligations as fell to them under the forest act, and have responded readily to the various calls upon them for information with reference to their respective localities. There has been a generous backing given to the Commission by the people, which has greatly strengthened their hands and encouraged them in their undertaking. If the tone of the public press and the assurances contained in personal letters are any indication, the people are in cordial and universal sympathy with the object of the Commission. There is a public demand for the work that it is doing that cannot and will not be ignored. Whether or not it falls to the lot of the Forest Commission, as now constituted, to do this work, is a question of minor importance, but it cannot be doubted that the work must be done.

A GLANCE BACKWARD.

COLONIAL AND STATE LEGISLATION.

Even in colonial times there seems to have been felt the necessity of adopting some plan to save the forests. The Colony of Connecticut, as early as 1640, enacted a law "in order that the timber should not be wasted, none should be cut or exported except by special license from the court, and no trees should be permitted to be felled except after the fall of the leaf." That was probably the earliest forest legislation in this country. In 1650 the Director and Council of the New Netherlands, acting for the West India Company, granted to "freemen the liberty to cut and draw from the public forests as much firewood and timber as they should require," but in 1669 the Earl of Bellomont wrote to the Lords of Trade that "the cutting of big pines fit for masts and the king's ships had been prohibited by proclamation." Means had been already taken to preserve the forests from fires.

At a meeting of the Court of Assizes, October 7, 1671, this item stands recorded: "Mr. Hallett's Peticon to have an order made

conformable to a former ord^r of Assizes, Anno 1669, the which was about Barking of Trees to p^rvent ye destroying of his Timber by Tanners and Strangers. It was granted."

The council passed an order, April 8, 1676, "That for the future no Tree bee cutt for planks or other use for sale, butt from the Latter end of November to the beginning of March, and the tree not to bee lesse than twenty inches through."

In 1700 Bellomont again writes, urging that an act be passed, "obliging everybody who cuts down a tree to plant four or five young trees in its stead, which, I am told, is the custom in Norway, otherwise the woods in Norway would have been exhausted long ago."

During the next decade the waste of woods began to be seriously felt, and in 1710 an act was suggested imposing a fine of £100 for every tree cut or destroyed, except by the government's permission. In 1723 Gov. Cadwallader Colden recommended "that white pines be planted, one for each tree cut down or dying."

The Earl of Hillsborough, in 1768, wrote to Gov. Moore, of New York, advising a survey of the pine districts and the adoption of measures to prevent any more waste or destruction therein. There was much correspondence during this period relating to the preservation of forests as necessary for furnishing masts and planks for ships, trees being evidently regarded as having been especially created for maintaining the King's navy.

In pressing his plans for the preservation of trees, the Earl of Bellomont pathetically says: The people of New York pay little heed to laws and proclamations and show no disposition to obey them," which may account for the fact that, notwithstanding all efforts, the pine trees disappeared from New York and is scarcely known to the children of to-day, except by the pictures in their school-books.

STEPS LEADING TO THE ESTABLISHMENT OF THE FOREST COMMISSION.

In 1791 the New York Society for the Promotion of Agriculture, Arts and Manufacturies recommended to the State that a system of tree planting be adopted, and appointed a committee "to consider the best modes of preserving and increasing the growth of wood and valuable timber." That committee reported in favor

of devoting lands least adapted to agricultural purposes to the cultivation of trees. Other recommendations and suggestions were also made by the committee, which were marked by a foresight and an understanding of the subject much in advance of that time, and which proposed the employment of many methods which are based on the knowledge and experience possessed to-day. The recommendations of that committee were not adopted. If they had been the State would have, without doubt, added largely to its wealth, and would have precluded the efforts required now to retrieve what it lost by its omissions then. So far as known, this was the first attempt made by this State in the direction of timber preservation and forest culture.

For nearly eighty years the propositions of the committee of the Agricultural Society slept an undisturbed sleep. It was not till 1869 that the Legislature of the State turned its attention to the subject of tree planting, when it passed a law to encourage planting trees by the sides of the public highways, and, in 1872, created by enactment "a Commission of State Parks," whose duty was "to inquire into the expediency of providing for vesting in the State the title to the timbered regions lying within the counties of Lewis, Essex, Clinton, Franklin, St. Lawrence, Herkimer and Hamilton, and converting the same into a public park." The Commissioners named in the act were Horatio Seymour, Patrick H. Agan, William B. Taylor, George H. Raynor, William A. Wheeler, Verplanck Colvin and Franklin B. Hough.

That Commission, known as the "Park Commission," made a report recommending that no more lands lying in the counties named should be sold, but that as lands were acquired by the State through tax sales they should be held for future forest management. The use of the word "park" in this connection was unfortunate, and it doubtless delayed the adoption of the methods recommended by the Commission. At all events, its recommendations were not acted upon until 1883, when a law was passed prohibiting further sales of land in the counties named in the act, and also in the counties of Saratoga and Warren. During the interval the sale of State lands had been continued, and in 1883 the State had a much less acreage in its possession than it would have had if it had adopted the recommendations contained in the committee's report as soon as they were made.

At the session of the Legislature in 1884 there was appropriated \$5,000, to be used by the Comptroller of the State in "the employment of such experts as he may deem necessary to investigate and report a system of forest preservation." In July of that year the Comptroller (Hon. Alfred C. Chapin) appointed as such experts Prof. Charles S. Sargeant, of Cambridge, Mass.; D. Willis James, Esq., of New York city; Hon. William A. Poucher, of Oswego, and Edward M. Shepard, Esq., of Brooklyn. The committee, so constituted, reported the result of their investigations, coupled with their recommendations as to future policy, to the Comptroller, in January, 1885, and in forwarding their report to the Legislature, Comptroller Chapin said: "The problem in its fullness affects the welfare of many sister commonwealths and of the nation at large. It is eminently fitting that in its solution the Empire State should lead the way."

As a sequel to, and the result of the recommendations of the Comptroller's committee, the bill establishing the Forest Commission was passed in the following May. Thus, nearly a century after the first suggestion that the State should inaugurate a policy of forest preservation and tree culture, a Commission was created to carry that policy into effect. In this matter, at least, the State cannot be accused of "hasty legislation."

HOW THE COMMISSION IS CONSTITUTED AND THE OBJECTS IN VIEW.

The New York Forest Commission is really the outgrowth of an intelligent public sentiment, which is not simply local, but national, and which has inspired the establishment of commissions of the same character by many States of the Union as well as by the general government.

In form the present Commission is constituted in accordance with the recommendations of the Comptroller's investigating committee, and the features of the Forest Act, also, under which the present Commission is governed, are substantially those recommended by that committee.

Whether the contemplated Forest Commission should be a "single-headed Commission," with a salary, or should consist of several, to serve without pay, was a question thoroughly weighed by the investigating committee in all its aspects, with the result that three of the four commissioners objected to the single-headed

paid Commission and advised the appointment of three unpaid Commissioners. This recommendation was adopted in the establishment of the present Commission.

The object had in view in appointing a Forest Commission was, generally, "the preservation of the forests." For the time being this could have meant little more than to stop the work of destruction, drive away timber thieves and trespassers, take efficient means to prevent forest fires, which had been so disastrous, and save to the State so much of its forests as were still in existence. Forest creation and forest culture, tree planting, sowing, thinning and all that pertains to strict methods of forest science, if contemplated at all, were held to be matters of the future. Denuded lands were, however, to be allowed to grow up to forests again in due course of time, by natural processes.

Those who were best qualified to judge deemed preservation of forests essential:

First. For the value of the timber, both present and future. With our rapidly growing population the demand for timber is daily increasing, while the supply is rapidly decreasing.

Second. For the value of our forests as sanitariums — health resorts for invalids, summer breathing places for all.

Third. For the conservation of our sources of water supply. Both science and observation agree that forests are the great reservoirs that hoard the rainfall to feed our brooks and rivers. The streams of Europe, it is well known, have shrunk as the forests have been cut away. Our own streams are following on in the same track, and the destruction of our forests cannot but lead to the same disastrous results that long ago came to the old world.

Fourth. For the increase of rainfall. Cautious scientific men are not yet ready to assert positively that forests increase the rainfall, but the theory has many supporters, and the belief is fast growing that forests are such an important factor in supplying moisture that it is a most dangerous policy to strip our country of its trees.

Fifth. For the climatic and sanitary influence of forests. There can be little doubt that forests are great equalizers of temperature, render the surrounding country less liable to violent winds, absorb malarial and noxious vapors and act in many ways beneficially to human health.

With all these facts in view and to help in attaining the purposes hinted at, the Forest Commission was established. It will be readily seen that theirs was not the work of a day. They were to begin at the very beginning, with little assistance in regard to theory or practice. The work to be done looked to the future and was to stretch over considerable periods of years. The investigating committee of 1884 comprehended and laid much stress on this. "The work," they said in their report, "will, especially at the outset, be of a character requiring undivided official attention; a careful study of business and scientific problems which are new in this country; the opportunity to conduct without interruption experiments stretching over several years, and a good knowledge of the varied relations of the forest problem as well as of the general interests of the State. The members (of the Forest Commission) should serve for considerable periods of time, in order that a fixed policy may be assured." This is too obvious to need argument. It is too late to question the desirability of the ends to be gained, and to gain these ends a definite and fixed method should be pursued. Any change of policy means delay and delay implies greater difficulties to be encountered and greater expenses to be incurred in the coming years.

FORESTS AND FORESTRY.

Historical records give us good reason to believe that the surface of the habitable earth was, with few exceptions, covered with a forest growth before it became the abode of man. This is inferred from the extensive vegetable remains, trunks, branches, roots, fruits, seeds and leaves of trees, so often found in conjunction with works of primitive art, in the boggy soil of districts where no forests appear to have existed within the era through which written annals reach; from ancient historical records which prove that large provinces, where the earth has long been bare of trees, were dotted with vast, almost unbroken woods, when first made known to Greek and Roman civilization; and from the state of much of North and South America when they were discovered and colonized by the European race*. When man first found himself obliged to subsist by tilling the soil he began to cut down the trees. They were, in some sort, his natural enemies—they stood in the way between

* Marsh's Man and Nature.

him and existence. As men multiplied the forests decreased. Fires and wars and wanton waste assisted the work of their destruction until the hand of civilization had robbed the old world of its forests as it is now making sad havoc with those of the new. In most parts of Europe the woods have been so nearly extirpated that mere protection of those that exist is considered by no means an adequate remedy for the evils resulting from the want of them; hence the great effort that is being made to supply their place by extensive tree plantations. Even in England, in spite of forest laws and other vigorous legislation, the forests have disappeared, until indigenous timber is extremely scarce there. In the reign of Henry VIII. we find old Thomas Tusser complaining that "men were more studious to cut down trees than to plant them," and Evelyn, in his "*Silva, or, a Discourse of Forest Trees,*" warns the English people that "this destruction (of forests) is now become so epidemical that unless some favorable expedient offers itself, and a way be seriously and speedily resolved upon for a future store, one of the most glorious and considerable bulwarks of this nation will, within a short time, be totally wanting to it."

At the present day forest plantations in England are large, well cared for, and yield considerable revenue. The total area of woodlands in Great Britain is stated at 2,515,491 acres, chiefly private property, as the Crownlands are only 125,000 acres. Natural indigenous timber is very scarce, and the woodlands consist almost entirely of plantations, which have been reared and are cared for at a large cost. Though they yield a good annual revenue the supply of timber obtained is a small fraction of that required for use in England, which is mainly furnished by importation from America and northern Europe. The prophecy of Evelyn has been fulfilled. The history of forests in England is practically that of all Europe; the original forests have been swept off and their places partially supplied by plantations at a great expense.

Forests are now regarded as of the greatest importance in the general economy of the earth, influencing the humidity of the air and the soil, mitigating the extremes of heat and cold, enriching the soil, supplying timber and fuel and furnishing a great variety of economical products. The physical history of every country proves that a moderate amount of forest promotes, in a high degree, both its agricultural and manufacturing interests, as well as

the productive resources of the country at large, and the beneficial influence of forests in a physical, economical and hygienic aspect is now receiving more of the attention that its importance deserves. The countries bordering on the Mediterranean have all suffered severely from the reckless and wholesale destruction of the woods which covered the mountain slopes, and many springs which formerly existed under the shelter of the forest have wholly disappeared. There can be no doubt that one of the causes of the terrible famines in India and China is the denudation of mountain slopes where the forests formerly absorbed a large portion of the rainfall which now runs off to the sea.

FOREST SCHOOLS.

Under the pressure of the necessity felt to restore the lost forests, the system of reconstruction and administration of forests has advanced in Europe to a science. Forestry, or silvaculture, has become a separate branch of education, in which Germany has taken the lead. France, Italy, Sweden, and even Russia, have successively established forest academies, and now the conservation of woodlands occupies the legislation of almost all civilized countries. There is no separate school of forestry in Great Britain (unless quite recently established) and no legislation with regard to forest management. As the government, as before stated, has but a small proprietary interest in woodlands it has never interested itself sufficiently to establish forest academies, and does not undertake to control private management. Private owners are eager enough to conserve and develop their forests. Both education and educated men are easily obtainable from Germany and France, and forests are well managed. The Highland Agricultural Society of Scotland grants certificates, on examination, for proficiency in the theory and practice of forestry, and excellent instruction is given on collateral subjects at Edinburgh, Cirencester, Dublin and at other places.

Training at the forest academies on the continent is very rigid and the methods pursued in forest culture are based on years of scientific, as well as practical, experiments and investigation.

As a sample let us look at the academy at Tharand, in Saxony, which enjoys a high reputation. The village is picturesquely situated on the River Weisserwitz. There is a large tract of wood-

land in the environs, owned by the State, and set apart chiefly for the use of the students. The object of the academy, as announced in the prospectus, is "to fit scientific foresters, through comprehensive instruction in forestry and its fundamental and kindred sciences, for a rational exercise of their vocation, as well as to promote the development of forestry in general." There are twelve professors, and the course of study, for which three years is required, is given in the following plan :

Natural Science.—General, technical and agricultural chemistry ; mineralogy ; geognosy, with particular reference to the knowledge of the soil ; general botany ; anatomy and physiology of plants ; forestial botany ; general zoölogy ; science of the vertebrates ; forestial entomology ; plant diseases ; physics ; meteorology.

Mathematics.—Fundamental mathematics ; differential and integral calculus ; surveying, including plan drawing ; mechanics and machine construction ; road construction ; general agriculture.

Special Preparatory Sciences.—History and literature of forest management ; cultivation and protection of forests ; forest mathematics (study of measuring wood, standing and cut ; calculation of increase by growth ; forestry finance, etc.) ; uses of forest productions and technology ; art of dividing forests into districts ; administration of forests, with especial reference to forest government in Saxony ; policing of forests ; art of hunting.

Supplementary Kindred Sciences.—Science of finance ; jurisprudence ; theory of agriculture—rural economy ; meadow cultivation.

Much time is devoted to the study of plant diseases, fungus growth and injuries done by insects. The schedule of studies includes a close investigation of the habits of trees ; when and where they should be planted ; how the climate affects their growth and vigor ; the proper preparation of the ground where they are to be planted ; at what season and in what manner they are to be felled ; how trees are selected for cutting, with instructions as to the proper tools to be used ; the terms of maturity of different kinds of trees ; methods of thinning the forest (interlucation) ; the use of the different woods and how they are best employed mechanically, (*e. g.*, for different parts of carriages and wagons, railway coaches, ships, furniture, tool handles, carpenter's work, dams, etc., very much in detail) ; methods of preserving woods ; methods of

estimating values of both standing and felled timber; at what seasons different trees have the greatest value; the use of leaves for bedding for animals; gathering of sticks and fallen limbs for fuel; the relative value of woods for fuel; the irrigation of timber lands; investigation of the relation of forests to the drainage of the soil, and many other details that are considered essential for a proper and full education in forestry.

Those students who can pass the rigid examination required at the end of the course are considered fitted to be employed by the government. The academy has a large library, filled with works on forestry, say 10,000 volumes, the literature of forestry in Germany being very full. It has also a chemical laboratory, a large cabinet of woods, showing natural as well as abnormal and diseased growths, injuries by insects, etc.; a forest garden for experimental work in developing trees, and in fact all the appliances and appurtenances necessary for enforcing, applying and illustrating the studies. Students make frequent and long excursions into the country and forests for practical work under their teachers' directions. The students are worked for six days in each week, from 7 A. M. to 6 P. M., with an intermission from 12 M. to 2 P. M.

We have entered into what may seem as prolix details regarding the course and character of studies pursued at the Tharand Academy (which is only one of several similar academies in Germany) for the purpose of showing our readers what an education in forestry implies and what is meant by a "scientifically educated forester." They will, perhaps, better appreciate what we have before said as to the difficulty of finding "educated foresters" in the North Woods. It is by no means implied that at present men so educated are needed here, that such academies as that at Tharand should be established, nor that European methods for developing and managing forests ought, or could be applied to forestry work in America. The Europeans have been brought to this need by necessity. Let us be wise in time, profiting by their experience.

We can save what is left of our forests and teach our people how to put them to their best and proper uses, so that the time may never come when we shall be compelled to learn the science of forestry as taught, nor to adopt the rigid scientific methods that are practiced in Europe, in order to re-create them. Yet we may learn much from the Europeans. The fundamental principles of forestry

hold good here. The results of scientific investigations we can surely profit by and make such knowledge our own, to be used or adapted as occasion may require, although we would not wish to see our forest reduced to the artificial and park-like appearance of most of the forests of Europe, whence nature is well nigh banished. Every leaf is swept up and every twig carefully gathered and put to use; nothing is wasted. It is evidently thought that the forest leaves are more valuable for litter than as a covering for the roots of the trees. Those who ride through the forest of Fontainebleau will see magnificent trees indeed, but the feeling that they are in a nobleman's park rather than in a forest cannot be shaken off. Nature is seldom allowed to have its own way in European forests. But that there should be more intelligence publicly diffused and more instruction given in our schools, academies and colleges on this subject needs no demonstration. The present want of even a general knowledge of our trees and plants is lamentable. How few of our young people know our native trees even by name, much less are able to distinguish them from each other — a walnut tree from a butternut, or either from a hickory; a sugar from a swamp maple, or a slippery elm from any other elm? More than likely they could not tell an elm from a hickory. The writer has seen farmers' boys who had never been a hundred miles from their native fields, ignorant of the names even, much more the qualities of the commonest herbs, such as pennyroyal, catnip and mayweed. Nor are their elders much wiser in this respect than the young people. It is certainly not asking too much when it is urged that this deficiency be supplied in the coming generation. They should certainly be instructed as to the names, habits and characteristics of our native trees and plants.

Added to this there should be given them a knowledge of the soil best adapted to each, how and where they grow, what kind of leaves, flowers or fruit they produce, to what uses the wood of different trees is best adapted, what sort of bark covers them and its nature and uses. If only this elementary instruction were given to our children it would prove a great source of pleasure and of probable advantage to them in after years. Our woodsmen should be taught the art of tree-planting, as well as how and when to cut the trees, and what trees are fit for cutting, and then be compelled to practice what they know, instead of shearing our forest lands as

with a horse-clipper, cutting down every green thing. All this, however, is practical elementary knowledge, not science; and when the day comes that the children can acquire an elementary knowledge of the natural history of trees in the schools we shall have made a long stride in the direction of learning forestry. An interest in and a love for our trees and forests will naturally follow this wider intelligence and this in turn will be followed by a wise effort to preserve them. The preservation of forests — not their re-creation — is the especial object now sought and worked for.

The elementary instruction here indicated will lay the foundation for that more exact and scientific branch of learning designated by the term of forestry, or the science of forestry, which indeed may be pursued with great delight abstractly, and which may be much needed in the near future, if the destruction of our forests is allowed to continue.

One means of public instruction is easy and available. It is to stock all public parks and gardens with our native trees, shrubs and vines; our woods furnish abundant material for decorative purposes. Exotics are not to be crowded out, but for the present let our native growths have the precedence in the parks of our cities and villages; then let the name of each be put upon it, so that he who strolls may read. Thirst for this sort of knowledge is growing, but the knowledge is hard to get; this is a simple way of furnishing it and it will lead to acquiring more. Many a time has the writer been appealed to for information about trees and plants growing in our parks, of which neither the laborer who set them out, nor the guardian of the place, nor yet the "park commissioners" could tell the names. Central Park, in New York city, could be made a great educational institution at a small expense, if properly managed in this respect; and what could be done on a grand scale in Central Park could be done in every village green on a correspondingly smaller scale. In this way children would early become familiar with the names and external characteristics of trees and plants. Their interest would be aroused and a good foundation laid for a further and more complete knowledge.

INFLUENCE OF FORESTS ON CLIMATE, HEALTH,
RAINFALL AND WATER SUPPLY.

All the problems connected with the influences of forests on the climate, on human health, on the amount of precipitation, and the supply of water to our springs and rivers have been, for many years, undergoing discussion and investigation, without such definite and scientific solution being reached as to enable a positive opinion on all points to be given. That large tracts of forests exert great influences there can be no doubt, but the factors in some of the questions at issue are too many, the conditions too variable and conflicting, the results sought too closely locked with and reacting upon each other to state the case arbitrarily and dogmatically here, nor can these questions be considered except in connection with each other. They are, however, questions of vital importance and full of interest. A brief review of the researches that have been made, of facts presented and opinions held by investigators and scientists, it is hoped will serve to call public attention more directly to these subjects and elicit new facts and fuller information. The problems especially relating to the effects of forests upon climate and health are very complicated and not yet fully understood. In his work on *Man and Nature*, Mr. Marsh, speaking of the influence of forests on temperature says: "So far as we are able to sum up the results, it would appear that in the countries in the temperate zone still chiefly covered with wood, the summers would be cooler, moister, shorter; the winters milder, drier, longer than in the same regions, after the removal of the forest." And again: "The roots of large trees penetrate beneath the superficial strata and reach earth of nearly a constant temperature, corresponding to the mean for the entire year. As conductors they convey the heat of the atmosphere to the earth when the earth is cooler than the air, and transmit it in the contrary direction when the temperature of the earth is higher than that of the atmosphere. Of course, then, as conductors, they tend to equalize the temperature of the earth and air. * * * As a living organism the forest tends, on the one hand, to diminish the humidity of the air, by drawing moisture from it, and on the other to increase that humidity by pouring out into the atmosphere, in vaporous form, the water it draws up through its roots. This last operation, at the same time

lowers the temperature of the air in contact with, or in proximity to the wood, by the same law as in other cases of the conversion of water into vapor. We cannot measure the value of any one of these elements of climatic disturbance, raising or lowering of the temperature, increase or diminution of humidity; nor can we say that in any one fixed cycle, however long or short, they balance and compensate each other. They are sometimes, but certainly not always, contemporaneous in their action, whether this tendency is in the same or in opposite directions, and therefore, their influence is sometimes cumulative, sometimes conflicting; but, upon the whole, their general effect seems to be to mitigate extremes of atmospheric heat and cold, moisture and drought. They serve as equalizers of temperature and humidity, and it is highly probable that, in analogy with most other works and workings of nature, they, at certain or uncertain periods, restore the equilibrium which, whether as lifeless masses, or as living organisms, they may have temporarily disturbed."

As to the hygienic value of forests, Mr. Elizur Wright, of Boston, says: "No sooner was the air by the paleozoic forests made fit for breathing animals, than these, in the act of breathing, poured more carbonic acid gas into the air, so that the trees or some other powerful deoxidizer must still keep at work purifying the air, or the breathing animals would be stifled; for be it remembered that carbonic acid, though it mixes freely with common air, is so much heavier that it is always found in the largest proportion near the surface. However it may have come about, what exists to-day is, that animals and vegetables are dependent upon each other. The warm-blooded animal is constantly pouring out of his blood, through his lungs, waste carbon, in the shape of carbonic acid gas, and the tree is constantly absorbing that carbon through its leaves and releasing the oxygen. We must not argue from the vastness of the atmosphere that the animals can get along without the trees. * * * Where is any other deoxidizer that works on a sufficiently large scale? Observe that men and domestic animals not only multiply by millions on the face of the earth, but they are disemboweling the earth of its coal and burning it by hundreds of millions of tons a year, which means that they are doing much to put the atmosphere in that condition in which only saurian monsters could live. The tall chimneys carry much of the carbonic acid far above our heads,

and the kind winds waft it away to the mountain sides, where it feeds the hungry trees. * * * Keeping up a fit proportion of forests to arable land, is the prime condition of human health. If the trees go, men must decay. Whoever works for the forests works for the happiness and permanence of our civilization. A tree may be an obstruction, but it is never useless. Now is the time to work if we are to be blessed and not cursed by the people of the twentieth and twenty-first centuries. The nation that neglects its forests is surely destined to ruin."

Prof. Balfour, of Edinburgh, after citing and considering all the various opinions and theories of naturalists on the subject, says: "From all that has been stated, it would appear that an absorption of carbonic acid by the leaves of plants and an elimination of oxygen takes place during daylight, and that this process ceases in a great measure during the night. The exhalation of carbonic acid by healthy leaves is still doubtful, and the appearance of this acid gas may, in many of the experiments, be traced to an abnormal condition of the leaves. The great function of the leaves thus seems to be deoxydization, by means of which they are instrumental in keeping up the purity of the atmosphere. This function of plants is antagonistic in its results to animal respiration; for while the latter takes oxygen from the atmosphere, and replaces it by carbonic acid, the former removes carbonic acid, fixes carbon, and gives out oxygen. The processes of respiration and combustion are pouring into the atmosphere a large quantity of carbonic acid gas, while the active leaves of plants are constantly removing it, and, under the action of light, substituting oxygen. While plants thus get carbonaceous food, the air is by them kept in a state fitted for animal life."

Prof. Ferdinand Cohn, of Breslau, says: "The leaves are cell-villages which perform their daily tasks in the air and in the light. Their principal business is to obtain coal, which is the chief constituent of the vegetable body. Our atmosphere is an enormous coal mine, many miles in thickness, that cannot be exhausted in thousands of thousands of years. The coal, indeed, is not found pure in the air any more than the metal in the ore, but is, in combination with oxygen as a transparent gas, carbonic acid, and a peculiar art is required to separate it.

"In the mining districts, smelting houses are erected beside the pits, where the noble metal is extracted from the impure ores.

The green cells of the leaves combine the art of the miner with that of the smelter, and have the power of extracting the pure carbon from the atmosphere. In order to perform this work they must be shown up by the sun, for the sunlight alone can excite in them the marvellous faculty. Having extracted the carbon they combine it with water and with the mineral substances that have been drawn from the soil, and prepare from them the living matters out of which the plant itself builds up its cells and which, taken up into the body of an animal, are transformed by it into flesh and blood.

Prof. Schacht of the University of Bonn, says: "A mountain cliff, or a forest, are the natural protection against wind. In this respect, the forest cannot be without beneficial effect on the adjacent country; the young growth of trees flourishes, screened from the force of the wind, the arable land develops itself better, and the noxious influence of dry winds is turned aside. It is an indisputable fact that the forests exercise a salutary influence upon the temperature of a country." The value of trees as a protection against malaria is attracting much attention and in many places the planting of trees in malarious districts has been followed, apparently, with beneficial effects. "It has been observed," says Becquerel, "that humid air charged with miasmata is deprived of them in passing through the forest." The belief that trees planted in rows or belts afford an important protection against malarious and miasmatic vapors obtained long ago firm foothold in Italy and is now generally adopted, and the beneficial effects of a forest wall as a protection against noxious exhalations from marshes or other sources of disease are very generally admitted.

The United States Division of Forestry, having undertaken to collect information on the general sanitary effects of forests, with reference to our own country, announces in the annual report for 1885:

"As to the influence of forests upon climate the replies to the circulars are less satisfactory and of less value than they are in regard to the effects of forests upon the flow of the streams, as might have been expected. It requires a nicer and more methodical observation to ascertain the former than the latter. The shrinkage of streams and the alternations of flood and drought are obvious to all who dwell near them, whether they are intelligent enough to assign the proper causes of them or not. The occasional testimony of

the eye is all sufficient. But, it is only a higher order of observers who are competent to give testimony as to variations of climate and the extent to which such variations should be ascribed to one cause or another. We shall have to wait, therefore, until we have such observers in sufficient number and they have extended their observations over a sufficient length of time to eliminate errors which may attach to particular instances, before we shall have a body of evidence which will be generally accepted as conclusive. Meantime we must depend upon the results of the observations which have been made by competent persons in other countries where the study of forestry has long been prosecuted and is not a novelty of the day. We have some truly scientific observers in regard to this as well as other subjects. They are doing useful work. But we need many more for the wide expanse of our country, not only in connection with our colleges and scientific academies, but in all our cities and larger, not to say smaller, towns. It is only by the careful comparison of a multitude of such observations, reaching through many years, that we can arrive at satisfactory conclusions. No agricultural college, at this day, should be regarded as doing its proper work, or as worthy of the name it bears, which has not a chair for instruction in forestry, in connection with which systematic observations in regard to the influence of forests on climate are made."

Many think with Prof. Brewer of Yale College that, the chief sanitary value of forests is secondary, by their aid in furnishing water, or in hoarding the water supply. As to the aid that forests lend to the accomplishment of these ends there seems to be little doubt, and a fair unanimity of opinion. Whether, or not, rainfall is actually augmented by forests is still a mooted question, and notwithstanding much discussion as to the influence of forests on precipitation, there is yet much difference of opinion as to the effect of that influence and the way in which it is exerted, if exerted at all. In his discussion of the subject, Marsh, while questioning whether, taking the whole surface of the earth together, forests sensibly effect the total quantity of precipitation, or even that they had this influence when their extent was much greater than at present, he yet gives it as the opinion of the majority of foresters and physicists who have studied the question, that in many, if not in all cases, the destruction of the woods has been followed by a

diminution in the annual quantity of rain and dew. We cannot positively affirm, he says, that the total annual quantity of rain is diminished or increased by the destruction of the woods, though both theoretical considerations and the balance of testimony strongly favor the opinion that more rain falls in wooded than in open countries. An eminent French writer, Boussingault, whose observations on the drying up of lakes and springs from the destruction of the woods in tropical America, have often been cited as a conclusive proof that the quantity of rain was thereby diminished, after examining the question with much care remarks, "in my judgment, it is settled that very large clearings must diminish the annual fall of rain in a country, and that arguing from meteorological facts collected in the equinoctial regions there is a reason to presume that clearings diminish the annual fall of rain."

"It is not necessary," says Mr. George B. Loring of Massachusetts, in his address to the American Forestry Congress at St. Paul, "to assume that forests induce a heavier rainfall, or even to show that they influence locally the distribution of rain, to prove their beneficence in regulating the moisture available for the use of agriculture. The foliage of forests resists the violence of storms, breaks the force of the rainfall which percolates through the covering of leaves and moss, and is absorbed by the humus beneath to be given out by the slow process of retarded evaporation, the surplus finding its way to the springs deep in the earth. In an open field the storm beats with unbroken violence upon the surface impacted and hardened under the rays of the sun, fails to penetrate the soil, and rushes on in turbid streams down the slopes to swell the brooks and rivers, and instead of refreshing the earth, scarifying and wasting it. The world is full of examples of once verdant and productive areas which have become burned and blackened deserts. The gradual desiccation of the once green and productive islands of the West Indies, Santa Cruz and St. Thomas, which has been progressing for many years, is the result of the destruction of private forests. The little Island of Curacao, where rich plantations, beautiful villas and terraced gardens have given place to aridity and desolation, because of the export of its valuable timber, is a striking illustration of the changes wrought by forest destruction. The entire coast of the Mediterranean, once the garden of the world, has been blighted into comparative barrenness by the denudation of the forest areas.

A portion of this territory, the Karst region of southern Austria, bordering on the Adriatic, has been the scene of extensive reforesting work of the Austrian government. Centuries ago it was covered with magnificent oak forests, and furnished piles and ship-building timber to Venice during her brilliant maritime career. So dense was the forest upon the Istrian coast that a squirrel could traverse it for miles on the branches of the trees. It was plundered systematically by Venetian spoilers, till the whole region was reduced to barrenness and poverty. For a score of miles north of Trieste the soil itself was washed away by the floods after the exportation of timber had been followed by relentless fires, leaving the bare rock in rugged masses as the sole covering of the surface. The work of restoration, commenced nearly twenty years ago, was one of exceeding difficulty. Exposure to sun and rain had exhausted the fertility of any remaining forest humus; the underlying masses of chalk were seamed and honeycombed with cavities requiring a mixture of underlying clay to sprout either grass-seed or tree-seed. Millions of trees were annually supplied by the government nurseries of Austrian pine, ash, larch and other varieties, and year after year the slow and patient effort has been continued with results that promise the ultimate renovation of a vast area of several hundred thousand trees, though the blasted district is yet a scene of comparative desolation, requiring millions of treasure and years of patient labor to restore a tithe of its profusion of forest wealth.

The productive capacity of the United States is due not alone to the great fertility of its central areas, but, in a large measure, to the amount and reasonable distribution of the rainfall. The lower latitudes, the Southern States, where high temperatures prevail and evaporation is greatest, have a rainfall of forty, fifty and sixty inches annually, with a liberal distribution through the summer months. The lake region and the Ohio basin have less, yet a good supply, suited to more temperate conditions, a lower temperature and less evaporation. Yet the droughts that occasionally prevail, and which are most severe on the borders of the wooded belt, as in Texas, Kansas, Missouri and Illinois, should admonish us to avail ourselves of the local benefits of forests in the equalization and conservation of the rainfall actually received."

In Prof. Hinrich's report of the Iowa weather service it is stated that it was shown by observation in 1875-76, that in Iowa the lines of equal rainfall are closely related to lines of equal amount of forest surface, and that those parts of the State which have a high percentage of forest surface have received a greater amount of rainfall. Inspector Carpenter of the Forest Commission, in speaking of the Adirondack Preserve, says: "No doubt some of the lands are absolutely worthless and will grow no green thing, but the average of the lands are covered with a medium thick timber growth, and are, in every sense of the word, forest lands; they perform all the functions of a forest as far as precipitation of moisture and maintaining an equable flow of water in the streams and rivers is concerned. I have seen the clouds hang for days over hills on which there was hardly one hundred dollars worth of merchantable timber, and the passenger through such timber would be treated to the chilly effects of copious moisture and even showers of rain, while in the cleared and denuded sections half a mile away in the lowlands, no drop of water fell, or overplus of moisture existed in the atmosphere."

"Facts would indicate" says Boussingault, "that where clearings have been made it rains less than before, and this is the generally received opinion." But whatever may be the influence of forests on precipitation and whether or not they increase the amount of dew and rainfall, there seems to be abundant proof in support of the theory that the clearing of woods tends to diminish the flow of springs and the humidity of the soil. "It is well established" writes an author before quoted, "that the protection afforded by the forest against the escape of moisture from the soil, insures the permanence and regularity of natural springs, not only within the limits of the wood but at some distance beyond their borders, and thus contributes to the supply of one element essential to both animal and vegetable life. As the forests are destroyed, the springs which flowed from the woods and consequently the greater water-courses fed by them, diminish both in number and volume. This fact is so familiar throughout the American States and the British Provinces, that there are few old residents of the interior of those districts who are not able to testify to its truth as a matter of personal observation. My own recollection suggests to me many instances of this sort, and I remember one case where a small

mountain spring, which disappeared soon after the clearing of the ground where it rose, was recovered by simply allowing the bushes and young trees to grow up on a rocky knoll not more than half an acre in extent immediately above it, and has since continued to flow uninterruptedly." *

Facts in support of this theory could be multiplied much beyond our limits. Its truth has long been recognized in Europe and utilized in reforestation for the purpose of restoring the lost springs and replenishing the flow of rivers. The effect of deforestation on the rivers of Europe has been very marked.

In a pamphlet, republished by the United States government, Gustave Wex, councillor of State of Austria, gives an exhibit of the average annual decrease in the height of the water in a number of rivers. These observations extended over a number of years and show that the sinking of the water surfaces has become much greater in the last two or three decades than formerly. This is explained by the fact that during these years there has been a great amount of clearing, drainage of ponds and marshes, and improvement and irrigation of large tracts. The average decrease, while not large, is alarming, inasmuch as it shows the possible danger in the future.

In the same pamphlet it was stated that the volume of water at the lowest stage of the river Sele has decreased thirty-three per cent during the last one hundred and fifty years; that of the river Brenta, at Bassane, seven per cent between 1864 and 1877, and that of the river Adda, where it flows out of Lake Como, thirteen per cent, between 1843 and 1862, due in each case, says Senator Torrelli, of Italy, to the clearings around the feeders.

A remarkable illustration of the fact that the clearing of hilly countries is likely to result in the complete failing of springs is given by Mr. Ney, who states that in Provence, after all the olive trees, which there formed regular forests, had been frozen, in 1822, and cut down, a great number of springs failed totally; and, besides, in the city of Orleans, after the surrounding heights had been thus cleared, nearly all the wells dried up and it became necessary to conduct the headwaters of the river Little Loire into the city.

* Marsh, Man and Nature.

At the international congress of land and forest culturists, at Vienna, a few years ago, it was stated that there had been a gradual decrease in the depth of the large streams of all countries. In some cases, it was said, rivers, which in former years had been of considerable magnitude, had entirely disappeared. The Rhine, the Elbe and the Oder are all shallower than formerly. The waters of the Elbe have diminished in depth ten feet in fifty years. The decrease in the waters of the Elbe was attributed to the reckless destructions of the forests of Bohemia, where it rises, while that of the Rhine was attributed to the felling of the trees in Switzerland, where are found the sources of that famous river.

M. Becquerel, in his essay on the "Climatic Effect of Forests," gives a number of instances of similar effects. M. Laussure, he says, notices the diminution of waters in the Swiss lakes as a result of clearing, especially in Lake Morat, Neufchatel and Bienne. Choiseul Gouffier was unable to find the Scamander river, which in the time of Pliny was still navigable. Its bed is now entirely dry, and the cedars that once covered mount Ida, where it took its rise, no longer exist. The history of Ovideo and the observations of Humboldt show that, owing to the removal of the forests, the city of New Valencia, in Venezuela, at the time of his visit, was very much farther away from Lake Tacarigua than when it was first settled, and that the waters of the lake had receded to the same extent. Boussingault, in 1822, learned from the inhabitants that the waters of the lake had risen and that lands formerly cultivated were under water. Previous to that time there had been a twenty-two years' war, during which the population of the valley had decreased, the lands were uncultivated and the forests, which in the tropics grow with great rapidity, had been restored. Between 1826 and 1830 the inhabitants of the metalliferous mountains of Marinate increased from a few negro slaves to three thousand workmen. Numerous establishments were erected, to supply which and for other necessary purposes, much of the wood had been cut. Within two years the effects of the clearings were seen in the decrease of the waters used in driving the mills, and that, too, while the rain gauge showed that a greater amount of water had fallen during the second year than during the first. The lakes in the valley of Mexico have greatly contracted since the time of the Aztecs. The city of Mexico formerly stood on several islands

in Lake Tezcuco. Largely in consequence of the removal of the forests that in ancient times clothed the neighboring hills, the lake has receded, and the present city, though occupying the same site, is now over two miles from its shores.

While the more level lands need to be, in some degree, covered with trees, in order to prevent the extremes of floods and drought, this is especially the case with mountain lands. The evil results of the cutting away of mountain forests are especially seen in the valleys and plains of the Alpine regions of France, Italy and Switzerland, where torrents have wrought fearful destruction. M. Gentil says that torrents are one of the most disastrous plagues of the high Alps, and Surrell says that the wild waters flowing in broad sheets over the surface of the ground, without bed, without ravine, have destroyed villages and have ruined whole districts which have been abandoned.

The history of France abounds in illustrations of the destructive powers of these mountain torrents. The floods in the valley of the Garonne some years ago destroyed, it is estimated, 15,000 lives. The losses of life and property caused by these torrential floods induced the French Government to take steps to reclothe the mountains with trees and vegetation. It is estimated that it will take one hundred and fifty years before the work contemplated is fully accomplished, but encouraging results have already followed the little that has been done.

It is not necessary, however, to go so long a distance for facts in confirmation of the theory that cutting down forests is followed by the drying up of springs and a diminution of the volume, as well as a great irregularity of flow of the water courses. Mr. David Thompson, of Cincinnati, said to the American Association for the Advancement of Science in 1881: "It is not unusual to find in many localities the beds of what were once important mill-streams, waterless, except when filled by sudden freshets; and in Ohio certain streams emptying into the lake, which were once declared navigable, will not now float a canoe. Previous to 1832 Captain Delorac, of Hamilton, Ohio, annually sent a fleet of flat boats down the Big Miami river at the spring rise; but with the destruction of the forests along that river, the rise became so uncertain that the enterprise was of necessity abandoned." Prof. Newberry, in his *Geology of Ohio*, states that the Ohio river has been getting

lower and lower, in dry seasons, for many years. During 1871, 1872 the Ohio sank lower than had been known before, and at Smith's Ferry, where the Pennsylvania line crosses, a ledge of rocks was laid bare that had not been seen or heard of by any people living in that vicinity.

The diminution in the minimum flow of the Schuylkill is well known and often cited. The report of William Ludlow, chief engineer of the Philadelphia water-works, for 1884, states that from the determinations of Mr. Edwin F. Smith, of the Schuylkill Navigation Company, an experienced observer, the minimum flow of the river in 1881, was under 170,000,000 gallons as compared with a previous determination in 1874, of 245,000,000, and in 1816, of 500,000,000, showing that the marked diminution in the minimum flow still continues. The total decrease in sixty-five years (1816-1881) has therefore been sixty-six per cent, an average of over one per cent per annum. The report adds that this remarkable decrease, not being accompanied by any great change in the rainfall, nor probably in the total annual discharge of the river, is no doubt largely due to the destruction of the forests within the drainage area, whereby the conservative action of woodland has been lost, and the rainfall is permitted to descend rapidly to the bed and pass off in a succession of freshets. It so happens, also, that this low water flow occurs precisely when the largest supply is required, viz., in summer; although a winter minimum also occurs during some years.

Several years since William Cullen Bryant wrote, with reference to our own State: "It is a common observation that our summers have become drier and our streams smaller. Take the Cuyahoga as an illustration. Once large barges went up and down that river, and one of the vessels engaged in the battle of Lake Erie was built at Old Portage, six miles north of Albion, and floated down to the lake. Now, in an ordinary stage of the water, a canoe or skiff can hardly pass down the stream. Many a boat of fifty tons burden has been built and loaded in the Tuscarawas, at New Portage, and sailed to New Orleans without breaking bulk. Now the river hardly affords a supply of water at New Portage for the canal. The same may be said of other streams; they are drying up. And from the same cause, the destruction of our forests, our summers are growing drier and our winters colder."

Hon. Warren Higley, of New York city, and President of the American Forestry Congress, said in his address before the Congress at Boston: "There is an abundant evidence of the effects of cutting off the forests. In Central New York, streams that thirty or forty years ago kept the ponds well filled for the saw-mill and grist-mill, and furnished a never-failing supply of running water for the farm, are now dry in summer, with the exception of here and there a stagnant pool; the dam is decayed and washed away, the mills gone, and the once picturesque scene is changed to that of desolation. Yet, with the warm rains of spring and the melting snows, the streams overflow their banks, the swift waters carry away fences, bridges and embankments, Spring opens later. The young cattle were wont to be turned into the wood-sheltered pasture about the first of April; now they are kept shut up until the middle of May. Peach orchards that were sure to be loaded every year with luscious fruit have almost disappeared, and the crop is the exception rather than the rule. The extremes of heat and cold are greater, and droughts in summer and floods in springtime are more frequent and more destructive. Trace the stream to its source and the cause of these things is apparent. The old Tamarack swamp, that used to supply the boys and girls with aromatic gum, and in which the creek had its source, has all been cut away. The thickly wooded black-ash swamps, through which the stream ran in its course to the lake, have been cleared, and their marshy areas have given place to cultivated fields and pastures. The cutting away the forests from the headwaters and the banks of the stream accounts for the changes I have noted, and this picture, I doubt not, is a very familiar one in the New England and Middle States. It is not difficult for men who know the effects of cutting the timber from small areas around the headwaters of the smaller streams to understand why summer navigation in the Mississippi, the Missouri and the Ohio has become difficult and at times impossible where it was easy and constant a few years ago; or why the Hudson or the Connecticut are much lower in summer and higher in spring than in former years. The partial deforesting of the Adirondack region has materially affected the flow of the Hudson, the Mohawk, the Black, and other rivers, and sufficiently demonstrated the fact that were this great watershed of New York stripped of its forest covering, the Empire State would lose her

prestige and New York city her rank as the first commercial city of the New World."

Information gathered by this Commission from the forest preserve goes to show the diminution of springs and streams in that region. Mr. C. B. Tillinghast writes that there has been "a falling off in the flow of certain streams and a noticeable change in the character of the timber along the brooks within a few years."

Mr. Morton S. Parmelee, of Malone, Franklin county, speaking from his own observation for the past ten years in that vicinity, says that some of the brooks and springs have dried up, and adds: "Whether the flow of the rivers is materially lessened is hard to state positively. It seems to me that our river (the Salmon), on which we run two gang saw-mills and a planing-mill, shrinks yearly, though now and then there is a wet season like 1886, which upsets the record. There is this to be said about the Salmon river: We own most of the land around its headwaters and we jealously guard the stream and its tributaries, not allowing the alders on its bank to be cut, or any timber except the large and dead spruces."

Mr. John C. Birdseye, Jr., of Onondaga county, informs us that the streams of that county, where he lived as a boy, have visibly failed within his memory, although he is still a young man only twenty-five years of age. There was, at Conkling's Falls, a grist and saw-mill which, he says, in his boyhood had a plentiful supply of water. Then it gradually diminished. At first a spasmodic flow was marked; heavy freshets in spring, then low water in summer, until the water failed and it was necessary to run the mills by steam. So at Pratt's Falls, a few years ago, the flow of water was abundant. The story was repeated there; violent freshets in spring followed by the usual failure, until now, in summer, hardly a pailful runs over the falls. In this latter case there was formerly a swamp, some five or six miles above the falls, which has been "reclaimed" and all the trees and shrubs cut off. All these changes have occurred within fifteen years.

The reports of the Superintendent of Public Works, make yearly appeals for the adoption of measures to replenish the constantly diminishing supply of water for our State canals and assert that observation shows the water in the upper Hudson and its tributary streams to be failing. Dr. Hough some years since called attention to the fact that all the streams in Albany county were subject to

extremes of flood and drought, and many now living can remember the ruins of grist and saw mills which once stood near Albany, and whose wheels were supplied with a plentiful and regular flow of water from streams whose beds are now dry, or only serve as channels for torrents which carry off heavy rains or melting snow. Not only in Albany county but in many counties of the State, can be seen cattle driven long distances during the summer to find water on farms whose brooks and springs yielded an ample store within the memory of those now living.

We have already given to our readers (page 15) Mr. Kenwill's letter testifying to his knowledge of springs having dried up that had heretofore never been dry. The report of the United States Forestry Division for 1885 asserts that "hardly anything can be regarded as being better settled, by extended observation, than that the forests are great regulators of the distribution of the water precipitated from the clouds, and consequently of the flow of streams. By their shade and by the obstruction which they offer to sweeping winds they lessen the evaporation which would otherwise carry off speedily from the ground much of the rainfall, while the loose, spongy soil, formed by the accumulation of their fallen leaves, absorbs the water precipitated from the sky or produced by the melting of the winter's snow, and cause it to flow off gradually into the channels of the streams instead of being allowed to flood them at once and produce at times devastating torrents. It is a well-established fact, obvious to all whose observation reaches through any considerable period of time, that with the clearing away of the forests to secure land for agricultural purposes or to convert them into lumber, the lesser streams have diminished in volume and the larger streams, for this reason, have become less navigable, and therefore less available for commerce. Instances might be adduced, without difficulty, of saw-mills and other wood-working establishments which have been erected upon streams flowing through or near forests, with the design of using the material near at hand, where the process of cutting away the trees has so diminished the amount of water that the requisite power has failed, and the owners have been compelled to build new dams and duplicate their machinery so as to use the diminished water supply a second time as the only means of continuing their business. The manufacturers, on many of our streams, have been obliged to thus

duplicate their machinery, or to build reservoirs at great cost, in which to store up the superabundant water of flood-times for use in times of drought, or to supplement their deficient water power by the introduction of the auxiliary power of steam."

In 1881 the State of New Hampshire appointed an able commission to inquire into the extent to which the forests of the State were being destroyed, and the effect produced by their destruction upon rainfall, ponds and streams. That commission, after protracted and extensive inquiry of several years, made its report, which is one of great value, not only for the people of New Hampshire, but for those of many other States. For the purpose of ascertaining the facts of the case the Commission sent out circulars to the town authorities and to many others, especially of the older inhabitants, asking them whether the amount of water in the streams, ponds and springs in their vicinity had diminished within their memory; and if so whether the removal of woods and forests had anything to do with it. From the replies to these circulars it is very clear that the destruction of the forests has had serious effects.

Among the facts reported the following may be taken as examples of the general testimony. A small stream in the southern part of the State in the town of Richmond, in 1865, furnished power sufficient for four saw-mills nearly all the year. It began to dry up as the cutting of the timber commenced in its vicinity, and the water and the woods have now disappeared together. In the adjoining towns of Fitzwilliam and Rindge the same results have been reached. Well known trout streams, once well stocked, are now dry one-half of the year, the ground having become treeless. In Chesterfield the flow of the streams is reported as more irregular than in early times. The same is true of the streams about Nashua. The Merrimac river, so important for manufacturing purposes, is protected from great variations in its volume from month to month by means of large ponds and dams, but one of the oldest inhabitants of Franklin, who has observed the river for sixty years, thinks its volume has diminished one-fourth in that period. One who has given much attention to the subject is confident that the water in the Contoocook river has decreased one-third, even within twenty years, and that its tributaries have fallen off still more. At Hanover it is said the Connecticut river for many years has been decreasing in volume, and with increasing rapidity the timber from its head-

waters has been floating by. In Canaan, sixty-five years ago, there were nine or more mills, abundant water power all the year round, no thought of reservoirs, double dams or precautions against drought. A native of the place, returning after an absence of thirty years, found the hills and rocks bare, the springs choked up and the mills obliged to resort to steam power or lie idle. Even in the northern counties, where the timber is still comparatively abundant, similar testimony is given. In the town of Littleton, three of its oldest citizens testify that the power of the Ammonoosuc at that point has diminished one-third within fifty or sixty years. An intelligent observer at Berlin, on the Androscoggin, says that the water in eight brooks and two ponds in his vicinity has materially diminished within twenty-six years. Six years ago he supplied his stock with water from what was then an unfailing brook, by means of an aqueduct, which furnished 300 gallons per hour. Now that the trees along the stream have been destroyed by the woodman's ax and by forest fires, his water supply is cut short in summer by drought and in winter by frost.

The geological character of New Hampshire is such that it must continue largely a wood and timber-bearing State. Nature herself, say the commissioners, "in the very configuration of the State's surface, and in the character of its soil, absolutely commands that whatever may be the preference of its inhabitants, at least one-half of it shall remain perpetually devoted to the production of wood and timber, and that what nature has unalterably ordained it becomes them to accept." Accepting this ordinance of nature, the wooded area in limited districts has been allowed to increase, and in every instance where the decrease of water power has been checked or averted, the commissioners say that it has been by means of the preservation or restoration of the forests. The regulative power of forests receives important testimony in its favor also from the geological report of the State, from which we have the statement that when in the central and southern portions of the State the hay crop has been cut short by drought, it has been known to be above the average in the northern part even with less rainfall, and for the reason that the forests secure a better distribution of the results of rainfall and melted snow. In short the proper storage and distribution of our water supply are of much greater importance to us than the amount received.

There are possible results, following the drying up of the streams through the unlimited destruction of forests, that should alarm the American people and cause them to make greater efforts to preserve the forests in localities where they now exist, and to cultivate them where they do not. History shows that not a few nations have declined with the disappearance of their forests; and upon the preservation of our water-courses may depend our existence as a nation. While the government ought to protect its own forests and especially its own mountain forests, it is the farmer and other small landowners who can effect the most good, and every influence possible should be exerted to induce them to reclothe a portion of their denuded lands. In this work the most effective agency would be the press, particularly the agricultural press, and it is hoped that it will agitate the subject until the desired result be brought about.*

By far the best summing up of all the evidence yet collected on the questions under discussion is contained in a treatise recently published by Dr. J. M. Anders, of Philadelphia. It is such an excellent digest of the results of the latest scientific investigations, accompanied with the deductions of one who has given much thought to the various problems involved, and so well adapted to our present purposes that we cannot do better than to furnish our readers with his conclusions. The following paragraphs, taken from his work,† are full of interest:

“Thus far the almost universal experience of tourists has been that wherever in past time the forests have been cleared away by a populace the effect has been most lamentable, the smaller streams drying up, followed by infertility of soil, insalubrity of climate, and sometimes utter desolation. Frequently associated with the extermination of the forests the population has been observed to be meagre. Though of a negative sort, the above statement, evidencing the baneful results of wholesale denudation of the land, serve in themselves to indicate the undoubted economic, industrial and hygienic value of forest trees to a people. And while it would be an easy task to multiply similar instances indefinitely, from the writings of the best minds of all past ages, to pursue further this line of evidence would be unnecessary, in view of the fact that the

* See Mr. Loring's address, before quoted.

† House Plants as Sanitary Agents, by J. M. Anders, M. D., Ph. D.. Philadelphia, J. B. Lippincott & Co., 1887.

writer purposes to bring forward the positive proof at hand, showing how forests favorably affect conditions of soil and climate.

"The relation of forest vegetation to the soil and running streams is a subject which has secured the attention of civilized nations of all ages, and it admits of approximate precision of statement, but since it in an indirect way only affects the question of their better climate influences, its discussion will here be limited to a few general considerations. A leading effect of wooded districts is to preserve the moisture of the soil without favoring excessive humidity of the superficial strata. To account for this it is necessary to consider, first, the action of the woods in impeding evaporation from their soil. That savant, Ebermayer, has, as the result of trustworthy meteorological observations of forestry, arrived at the following conclusions: 'If from the soil of an open space one hundred parts of water evaporate, then from the soil of a forest free from underwood thirty parts would evaporate, and from a soil covered with underwood only fifteen parts would evaporate.' In general the trees are always supplied with an abundance of moisture for transpiration, owing in great part to the power which the roots have to attract moisture from every direction and to direct the rainfall along their surfaces to great depths, partly by their power of retaining the rainfall in their network of smaller rootlets, to be in due season absorbed by the myriads of root-hairs, and partly also to the efficacy of the vegetable mould usually carpeting the soil of the forest to soak up water and preserve its running off rapidly through superficial channels. The action of forests in this regard, it will appear obvious to the reader, must vary greatly in accordance with their situation, being favored more by level than by sloping surfaces. On steep elevations their effect to nullify destructive avalanches is fully appreciated. The above facts furnish a simple interpretation of how tracts of woodland prevent freshets, which are known to produce marked destructive changes, more especially on the hillsides and mountainous slopes of unwooded districts. But they are worthy of elaborate mention chiefly as affecting agriculture and other industries of civilized life.

"The above facts also explain clearly how forests feed springs and maintain smaller streams on the one hand and with equal certainty why the clearing of wooded regions causes, as a necessary result, the drying up of wells, springs and rivulets.

"To show even more conclusively that streams and rivulets owe their origin and permanence to the wood land, they have reappeared after reforesting the places which had been cleared. Again, obviously, this influence of woods is of great importance to the inhabitants of cities, on account of its influence in maintaining and regulating the water supply. Another evil resulting from the disforestation of a large area is the occurrence of severe droughts, which are quite usually the consequence of excessive surface drainage, it having been established that less than one-third of the rainfall should directly drain off into the streams. As a matter of practical experience, the people of such localities suffer from frequent floods, followed by droughts, while their streams are subject to great vacillations. Since the forest soil is at all times provided with an adequate supply for transpiration, not excepting the dry seasons, and its moisture is ample to keep up the flow of springs perpetually, the equable humidity of forest soil as a factor in obviating droughts with their baneful consequences to crops of all sorts, with depopulation as the final result, is in point of practical import rarely equaled. The fact that the humidity of the forest soil is less variable than that outside sustains important etiological relations to certain epidemic diseases. The malarial germ, among other essential conditions, demands for its multiplication and development a certain degree of humidity of the soil. The reader should not fail to recount here the remaining concomitants of essential importance to produce the paroxysmal fevers, namely, a temperature not below 67° Fahr. and the direct action of the free oxygen of the air upon the malarial soil. This theory, advanced by Prof. Tommasi Crudeli, furnishes a satisfactory explanation of numerous phenomena connected with the various expressions of this disorder, hitherto inexplicable. The vexed question, what is the real relationship existing between forest vegetation and soil on the one hand and malarial fevers on the other, has in the past been much, though variously, discussed. The branch of this theme relating to the part played by growing vegetation involves issues which may, for convenience of arrangement, be discussed under three heads: The chemico-vital influence of trees; their mechanical influence in arresting the convection of malaria; their influence upon the humidity of the soil.

"With regard to the last element it is necessary only to state that the physiological functions of vegetable life, transpiration in particular, under ordinary circumstances tends rather to lessen than to augment the moisture of the forest soil. The foundation of experimental proof, which seems to be ample to establish this proposition, will be hereafter furnished when treating of transpiration from the forest. On the other hand, the value of subsoil drainage, it may be stated, with the view of ridding highly malarial soil of its redundant moisture, can be proved by a consensus of medical opinion, and in consequence of a full appreciation of this fact numerous hydraulic systems have been devised, with varying, though on the whole excellent results. To achieve the same happy object it has been recommended to plant trees, the number to be proportionate to the needs and extent of any special locality. This application of a scientific principle is best adapted to soils having no natural subsoil drainage, as for example, in marshy districts, under which conditions they have a decided drying effect. The rate of the process of transpiration is practically uniform during clear weather, thus speedily getting rid of the redundancy, especially during dry periods. Again, the trunks of the trees and their branches act as large and efficient reservoirs for the storage of a considerable part of the rainfall, and this is drunk up by the roots almost as soon as precipitated. From these considerations it would be naturally inferred, therefore, that low, marshy ground would be rendered drier by the cultivation of trees in due proportion. Happily there is historical basis for familiar observations of a practical kind to bear out this idea, though space fails me to cite more than two authorities. In a parliamentary report of the resources and needs of Ireland for forest cultivation, Mr. D. Horwitz, forest conservator of Denmark, observes that 'swamps and morasses are created in Ireland from the want of trees to drink up the superfluous moisture.' According to the observations of Gimlet, in Algeria, extremely malarious districts have been rendered quite harmless in four or five years by the absorbent action of, and the evaporation from, the leaves of the eucalyptus globulus. * * *

"On the other hand, the disease not unfrequently has been observed to prevail extensively in districts where soil contained far less than the average per centum of ground-water. Indeed, whatever differences of opinion may exist as to the conditions to be exacted to

produce malaria, it is a remarkable fact that after a heavy rainfall a sinking of the ground-water below a certain level, as, for instance, during the dry period following in the wake of a heavy freshet, malarial outbreaks are both frequent and severe. In explanation of this fact, it may be stated that when the ground-water rises to a high mark the specific ferment may be carried near the exposed surface of the soil, in which situation it would afford opportunity to be operated upon by the two conditions, temperature and the free oxygen of the air, after the subsidence of the ground-water. Having shown forests to be preservers of a uniform degree of moisture in their soil, there can be no gainsaying their effectiveness in securing more or less freedom from malarial infection, under the conditions last named.

"Here dawns a remarkable truth. In all unwooded regions where the earth may be wholly dry one day and in consequence of storm subject to flood on the next, forest cultivation would constitute a prompt and efficient means of checkmating not only denudation and threatening unproductiveness of the soil, but also give a greater freedom from insurrections of "shakers." It is an all-important double fact to which earnest attention is here directed, to wit, that in low, moist or marshy localities forest culture, under proper regulation, forms an important factor in lessening the liability to malaria by lessening the humidity of the soil, while in hilly or mountainous regions forest growth likewise lessens the liability to this affection by maintaining a more rigidly uniform standard of moisture than outside, though in different degrees. The present inquiry, it should be noted, does not refer to residence under the shadow of an extended area of woods, but to a habitat in proximity to the latter, if regard be paid to the needs of the locality and to geographical distribution.

"One of the ways in which forests exert an influence upon the climate is by opposing resistance to the free passage of wind currents. This element of the question, though, perhaps, more firmly established than any other, is of too great importance to be disposed of in a summary manner. Evidently trees are well adapted to break the force of the winds, since the branches, and particularly the leaves, on account of their immense numbers and nearness to one another, act as efficient barriers; the trunk, in turn, holding up the bushy tree-top, defies the tempest, while the roots on their part

are extending their grip on "mother earth," in order to support the stem. The particles of air not checked by the first row of trees to the windward would, it is clear, have their force diminished, and would be promptly checked by the trees to the rear. In this manner considerable masses or even belts of trees, by intercepting strong wind currents, afford shelter to man, the crops, and humbler vegetation generally to the leeward, from the chilly blasts of winter as well as the drying winds of summer, thus having the effect to modify extremes of temperature, rendering summer less sultry and winter less severe.

"In tempering chilly spring and autumn winds, they lengthen relatively the warm season or term of vegetable growth and development. To the agriculturist this fact is highly important, since on the one hand certain crops are slow in maturing, and on the other the bleak winds are in many unwooded regions known to be highly unfavorable to the maturation of fruit crops and harvests. It has been many times observed that, given similar soils, fruit grown in the city surpasses in quality and size that grown in the country; a fact ascribable to the more effectual shelter in the former than in the latter locality.

"The temperature of the soil of the woodland is several degrees lower than that outside. According to Ebermayer, the trunks of the trees "breast-high" are 5° centigrade lower in temperature than the air of the forest; but this difference of temperature, it is to be noted, is nearly maintained when comparing the temperature of the tops of the forest trees with the forest air. Ebermayer speaks of the temperature of the trees in a forest as being always lower than the air of the forest. This admits of an explanation; the rapid transpiration of watery vapor from the foliage, beautifully shown by our own researches, renders the action of the solar rays neutral, thus reducing the temperature considerably.

"During the warm season the air of the forest is cooler than the open air; a fact due to several coöperative influences. The air of the forests contains a somewhat higher standard of average humidity, and any increase in the amount of moisture in the air, it is well understood, reduces the temperature, though the fall is not always proportional. That eminent physician, Dr. Frankland, is made to say that he considers the moisture in the atmosphere of England as lowering the temperature from fifteen to twenty-five degrees.

"There is yet another aspect of this branch of our theme worthy of brief consideration, the substance of it being embraced in the following query, namely: How does the temperature of the woodland air compare with the air devoid of vegetable growth in winter? In his valuable work on "Man and Nature" Marsh quoted Megrascher according to whom observation shows that the trees have a more uniform temperature than the atmosphere, or, in other words, the internal warmth of the trees does not rise and fall proportional to that of the atmosphere in general. He further contends, so long as the temperature of the latter is below 67° Fahr., that of the tree is higher; but if the temperature of the air rises to 67° Fahr., then the tree marks the lower. Without stopping to discuss this opinion which appears to rest upon exact scientific premises, it is to be remarked that if it be true, it affords another evidence of the cardinal fact that forests are natural equalizers of temperature, since such observations indisputably teach that the air encircling the forest is warmer in winter than the external.

"No other influence which forests exert upon climate, however, can claim so large a share of importance as that exercised upon the humidity of the air. The explanation of their effect upon this meteorological element is to be found in a study of the organic process previously discussed, namely, transpiration; but in some slight degree also in their mechanical influence. Among the latter effects there is to be observed, as before noted, the vegetable canopy above, which prevents in a great measure the rays of the sun from reaching the earth and warming it so as to facilitate evaporation from the soil. Again, by forming a more or less perfect screen interposed between sky and earth, forests in a measure intercept the dews and lighter rains which are at once returned to the atmosphere by evaporation, a small portion of this moisture only reaching the earth. The evaporation from the soil of the forest, computed by Ebermayer, is rather more than one-third as great as that from open soil, but this lessened surface evaporation is much more than counterbalanced by the transpiration from the forest.

"The old question, do forests in any degree influence the rainfall, is not as yet quite satisfactorily determined, since the total annual evaporation and precipitation bear a constant relation. That they do not, therefore, augment the total rainfall may be regarded as a thing definitely settled. But, on the other hand, the woodland

does possess a local influence upon precipitation, promoting gentle showers, and within certain areas of space and limits of time, influence both the amount and distribution. Their influence in these tendencies can be well understood by attention to the nature of certain meteorological phenomena.

"The question where and in what manner is the moisture given to the air by a forest condensed into rain, needs to be answered here. It is well to note first that rain, according to well-known meteorological principles, is usually formed at great heights, say from one to two miles above the earth's surface, hence it cannot reasonably be claimed that woods, under ordinary circumstances, materially affect the general course of storms. Forest-growth, when situated on mountains, besides favoring in a mechanical manner the ascent of vapor-laden currents to cooler regions where condensation occurs, might also, owing to their altitude, have their own moisture condensed into rain. Situated on a level tract or upon low elevations, the conditions are vastly less favorable. However, if the reader will reflect upon the demonstrable variations in the temperature of the air of forests and the currents outside, and the circumstances of these atmospheres commingling, it will doubtless appear that their temperature might be sufficiently reduced to cause local precipitation in the shape of light rains, mists and heavy dews. Continuing our line of reasoning a single step further; recalling how forests raise the degree of saturation of the air under their shadow, as well as of the adjacent atmosphere on all sides; also the well-known fact that the moist air discharges its vapor more easily in the form of rain than a drier atmosphere, we may be pardoned for drawing the inference that warm currents sweeping over a region of country and mingling with the moist air overhanging and surrounding the woodland, would have at least a portion of the atmospheric moisture condensed into gentle showers, shedding their enlivening influences over the neighboring landscape for a considerable distance. By increasing the frequency of light rains during the vegetative season, forests tend to obviate droughts, which result is of the highest importance to the farmers' crops, the climate and all growing vegetation. Our deductions, it is seen, have been drawn largely from the known facts of observation. Forests produce abundant dews. The formation of this substance depends upon two conditions, namely, the radiations from objects near the earth, and a

certain per centum of atmospheric moisture. As in the case of the production of rain, so in the case of dew, it is more easily formed in a moist than in a dry atmosphere, the former requiring less reduction of temperature; hence, when the additional moisture in the vicinity of the forest comes in contact with the night air, dew in abundance is frequently the result. There is nothing to oppose the view that the cooler atmosphere of the shade of the grove is a source of dew during the day under certain favorable conditions, the light breezes conveying their refreshing influences over the neighboring fields and into the valleys round about. When it is remembered that in some portions of our globe, Egypt and Arabia, for example, nearly all the moisture reaching the earth is in the shape of dew, the reader will grant that this is no mean office on the part of sylvan nature.

“Historically examining the question, it is found that there is no little conflict of evidence, though the weight of scientific opinion is strongly in favor of the doctrine that local precipitation is somewhat favored by plantations.

“Perhaps, from all the ascertainable facts of observation, we are not at present warranted in affirming positively that forest-growth has the power of increasing the actual annual rainfall. And it will be remembered that such a view has not here been contended for; but, on the other hand, from the great array of facts which have been amply verified both from speculative premises and by our experiments, as well as those recorded by other competent scientific observers, certain meteorological influences may, with certainty, be attributed to forests, namely, that they preserve not only a higher degree of saturation of the air in their vicinity, but also a more uniform proportion of moisture than is found elsewhere; they also greatly increase the dew-fall, produce heavy mists, and by promoting the frequency of gentle showers and light rains decrease proportionately the frequency of the occurrence of droughts, of heavy rains, and the ravages of torrents.

“As before intimated, under their own shadow and for some distance beyond their borders, within certain limits of time, they also increase the precipitation, and this effect being more strongly manifested during summer, when the danger from drought is greater than in winter, the signal value of their effect to equalize the dis-

tribution of the rainfall will, to the mind of the reader, be free from all doubt.

"In the case of precipitous mountain slopes, whose soil cannot be tilled, their forest covering should, if not already denuded, remain untouched, not only for the favorable effects this has upon the climate, but also in view of the fact that clearing under such circumstances is followed by destructive torrents and immeasurable damage to the surface soil. Similarly, when situated at the headwaters of streams, more especially when, as frequently occurs, these have their origin at the foot of mountainous elevations, forests are of incalculable value to promote their permanence, and should, when practicable, be preserved.

"What is more urgently needful is a legislative enactment that will insure the promotion of systematic sylvaculture worthy of the name, or the same object might be attained still more successfully by the appointment of a competent forestry commission in each State with view of securing better management of their individual forests. The latter course has recently been adopted by the State of New York, with much promise of effecting valuable work. The wisdom of the maintenance of a fair ratio of forest-growth, even though this should imply coercive policies, has from no other quarter received stronger evidence than is afforded by their climatic and sanitary advantages as herein presented. Of all national problems, there is none other of whose solution an enlightened public sentiment is so definitely valuable."

FLOODS AND TORRENTS.

While the destruction of forests is instrumental in drying up springs and in diminishing the volume of water in the rivers and brooks, on the other hand, it is with equally good reason believed that it contributes to sudden and destructive torrents and floods. The belief is entirely logical, and results from much careful observation. The spongy soil of the forest holds the water with which it is saturated by the rain and allows it to slowly trickle down to feed the springs below. Held firmly in place by the strong, interlacing roots of the trees and shrubs, it is not washed away by the most violent rains, but stores up the moisture that is supplied to it during the rainy seasons, to feed it out slowly to the springs during dry periods that may follow. The soil, being shaded from the sun

by the dense foliage of the trees, is kept cool, and the process of evaporation goes on much more slowly than on open, cleared lands. It has been observed that after the clearing of mountains rivers, which seemed to have lost a part of their water, sometimes suddenly swell and that too, frequently, to a degree which causes great disaster. After violent rains or sudden melting of snow, springs which had become almost exhausted, have burst out with impetuosity and, soon after, have dried up again. The reason for this is attributed to the fact that the forest acts as a regulator of the water flow, hoarding the water when there is an abundance of it and yielding it up when called for by the streams when wanted; but the forests being cleared away and the light, spongy soil being washed off the rocks, and evaporation taking place more rapidly, the storing process is no longer carried on, and the flow of water becomes irregular, in consequence of the clearing. This would happen, although the annual amount of rainfall was not lessened. The water supplied by rain or melting snow all runs off, after the forests are cleared, rapidly, causing torrents and floods, leaving the source of supply exhausted and, in consequence, the springs and streams run dry. The fact that floods are caused by cutting off forests is not of modern observation--it is nearly as old as the Christian era. The elder Pliny wrote in the first century, A. D.: "Destructive torrents are generally formed when hills are stripped of the trees." How violent torrents and disastrous floods have devastated the valleys of France, Italy, Austria, Spain and Switzerland is well known, and the facts are often cited. Recurring frequently for many years past since the forests were cut off they have devastated large areas of land, causing immense losses, both of property and human life. Reference has been made to this state of things in the foregoing pages, and we can do little more than to give here a passing glance to the mass of facts collected on this topic. Blanqui, as quoted by Marsh says that: "In a single day of flood the Ardèche, a river too insignificant to be known except in the local topography of France, contributed to the Rhone once and a half, and for three consecutive days one and one-third as much as the average delivery of the Nile, although the basin of Nile contains one million square miles or more than one thousand times as much as that of the Ardèche. * * * The water in Beaume, a tributary of the Ardèche, rose in 1772, thirty-five feet

above low-water, but the stream was fordable on the evening of the same day." And, again: "The Alps of Provence present a terrible aspect. In the more equable climate of northern France, one can form no conception of those parched mountain gorges where not even a bush can be found to shelter a bird, where, at most, the wanderer sees in summer here and there a withered lavender, where all the springs are dried up, and where a dead silence, hardly broken by the hum of an insect, prevails. But if a storm bursts forth, masses of water suddenly shoot from the mountain heights into the shattered gulfs, waste without irrigating, deluge without refreshing the soil they overflow in their swift descent, and leave it even more seared than it was from the want of moisture. Man at last retires from the fearful desert, and I have, the present season, found not a living soul in districts where I remember to have enjoyed hospitality thirty years ago. * * * The clear, brilliant Alpine sky of Embrun and Gap, of Barcelonnette and of Digne, which for months is without a cloud, produces droughts interrupted only by diluvial rains like those of the tropics. The abuse of the right of pasturage and the felling of the woods have stripped the soil of all its grass and all its trees, and the scorching sun bakes it to the consistence of porphyry. When moistened by the rain, as it has neither support nor cohesion, it rolls down to the valleys sometimes in floods, resembling black, yellow or reddish lava, sometimes in streams of pebbles and even huge blocks of stone, which pour down with a frightful roar, and in their swift course exhibit the most convulsive movements. If you overlook, from an eminence, one of these landscapes furrowed with so many ravines, it presents only images of desolation and death. Vast deposits of flinty pebbles, many feet in thickness, which have rolled down and spread far over the plain surround large trees, bury even their tops and rise above them, leaving to the husbandman no longer a ray of hope. One can imagine no sadder spectacle than the deep fissures in the flanks of the mountains which seem to have burst forth in eruption to cover the plains with their ruins. These gorges under the influence of the sun which cracks and shivers to fragments the very rocks, and of the rain which sweeps them down penetrate deeper and deeper into the heart of the mountain while the beds of the torrents issuing from them are sometimes raised several feet in a single year by the debris, so that they reach the

level of the bridges which, of course, are then carried off. The torrent beds are recognized at a great distance, as they issue from the mountains, and they spread themselves over the low grounds in fan-shaped expansions, like a mantel of stone, sometimes ten thousand feet wide, rising high at the center and curving towards the circumference till their lower edges meet the plain. Such is their aspect in dry weather. But no tongue can give an adequate description of their devastations in one of those sudden floods which resemble in almost none of their phenomena the action of ordinary river water. They are now no longer overflowing brooks, but real seas tumbling down in cataracts and rolling before them blocks of stone which are hurled forward by the shock of the waves like balls shot out by the explosion of gunpowder. * * * This is but an imperfect sketch of this scourge of the Alps. Its devastations are increasing with the progress of clearing, and every day turning a portion of our frontier departments into barren wastes."

Equally serious consequences have followed the destruction of forests in Italy. It has been calculated that four-tenths of the area of the Ligurian provinces have been washed away or rendered incapable of cultivation by the felling of the woods. According to Hummel the desolation of the Karst, the high plateau lying north of Trieste, for many years one of the most parched and barren districts in Europe, is owing to the felling of its woods to build the navies of Venice. Energetic efforts are being made by the Austrian government to reclaim this region from desolation by reforestation, and something in this direction has already been accomplished.

It is needless, however, to multiply instances which might be cited indefinitely; they are alluded to here merely to point out the danger that, if not provided against, threatens our own country. The same disasters may befall us as those which have brought such distress on the countries of Europe, unless we heed the warning given. We have had warnings, indeed, already, from within our own borders. That such consequences are quite possible in the United States has been shown by disastrous floods in Pennsylvania, where streams have risen so rapidly that people were glad to escape with their lives, and millions of dollars worth of property has been destroyed. It is stated on good authority that such changes have taken place in the flow of the Milwaukee river, from the

clearings around its headwaters, that while the mills and factories have been obliged in the dry season to resort to steam to supply the growing deficiency of water power, in the spring time floods sweep down the river with such fury as to carry away bridges and dams heretofore regarded secure against any force that the water was likely to bring; and what is true of that river is true of all the water-courses in Minnesota, from whose banks the forests have been cut off. "My engagements," writes Dr. B. G. Northrop, "led me along the valley of the Ohio river, soon after the destructive floods of 1883 and 1884. Aside from the more serious loss of life, the destruction of property in that valley alone, in 1883, was estimated at sixty million dollars. If there were less loss last spring (1884), when the flood was five feet higher and above all known precedent, it was because there remained less property to be destroyed; even then four hundred houses were seen floating by a single point. On a similar trip last spring I found great floods in the Cumberland, Tennessee, Mississippi and other rivers." Not many years ago a million dollars or more of property was destroyed at Rochester by a flood, regarded as unquestionably occasioned by the extensive clearings around the sources of the Genesee river. The heavy rains and warm winds, which rapidly melted the snow and supplied the floods at that time, could not have had so immediate an effect in a wooded country. "The connection between the denudation of forests and the floods of recent years," wrote the late Dr. Franklin B. Hough, a short time before his death, "cannot be mistaken." Again, Dr. Hough wrote, several years before: "This growing tendency to floods and droughts can be directly ascribed to the clearing up of woodlands, by which the rains quickly find their way into the streams, after swelling them into destructive floods, instead of sinking into the earth, to reappear as springs." The connection between forests and floods, that Dr. Hough speaks of, has long been understood in Europe and acted upon, to counteract the disastrous results of deforestation, by planting forests. Effective measures have been adopted by nearly all the European governments to re-establish forests by means of plantations, and at the present day millions of acres are covered with a vigorous forest growth, where once sterility and desolation held sway. The result has equaled the expectations and proved the wisdom of the policy adopted. What effect, generally reforestation has wrought may

be gathered from a single typical example. There stood a forest in the Commune of Labruguière, in the Department of Tarn, France, of more than 4,500 acres, owned by the commune, which was noted for its opposition to the forest regulations. The cutting of timber recklessly and the abuse of pasturage had converted the forest into an immense waste, so that the property would hardly pay the cost of guarding it. On the edge of the forest were located several fulling mills, whose wheels were turned by the water of the little Caanan brook, which had its rise in the forest and drained two thirds of its surface. When the forest was cut off and the soil denuded the waters of the brook after each rain swept violently down the valley, bringing great quantities of gravel, which still encumbers the channel of the stream. The mills were often compelled to stop in rainy seasons by the violence of the floods, and again, in summer there came such severe droughts that the wheels stood idle for want of water. The authorities began to instruct the population as to their true interests and finally induced them to inaugurate a system of reforestation by tree planting, which was well managed, and the new forest has now for some years been in vigorous growth. "In proportion as replanting went on," says the sub-inspector of these forests in his report, "the precarious use of the mills ceased and the region of the water-courses was greatly modified. They no longer swelled into sudden and violent floods, compelling the mills to stop, but a rise of water did not begin until six or eight hours after the falling of the rain; the streams rose steadily to their maximum and fell in the same way." Nor were the mills obliged to stop work for want of water, "of which there was always enough to run two or three mills. All other circumstances (except reforestation) had remained the same, and, therefore, we can only attribute to the regrowth of the forest the changes that occurred, namely, diminution of flood at the time of rain and an increase of the flow of water at other times."

The Rev. S. W. Powell, of Brooklyn, N. Y., has recently translated from the French a valuable little treatise, entitled *Les Etudes de Maître Pierre sur l'Agriculture et les Forêts* * (to which we shall have occasion to refer again a few pages further on), in the introduction to which he has given an interesting account of the

* The Studies of Master Peter on Agriculture and Forests.

causes which led to action taken in France for reforestation and what results have been accomplished. Mr. Powell says:

"In the year 1860, France began upon a new and successful plan a fight with certain lawless torrents, many of them tributary to the Rhone. For more than three hundred years the improvident wood cutting has been going on, which at last changed many of the streams of that region into torrents. The lower-lying and generally steeper slopes of their basins had been robbed by short-sighted owners of their protecting forests. Next, as the income from woodland became less, the impoverished peasants were tempted to overstock the higher and more level upland pastures with sheep and goats. The sharp hoofs of these animals, and their close bite when pressed by hunger, soon weakened the turf, which with more or less of the thin soil underneath, started down hill. Arriving at the steeper slopes formerly protected by the trees with their fallen leaves, roots and undergrowth—the water found nothing to check it till part of it could find the crevices leading to the springs, and there was nothing else to keep the rest from rushing too suddenly to the stream bed; but carrying with it the scanty soil of these denuded slopes, every yard of its descent would add to its volume, velocity and eroding power. By the time the stream was reached each drop would contain some grains of precious soil, to be washed down to the sea, or on its way there to be deposited where it would spoil rivers, channels and harbors. Besides this washing of soil, rocks and boulders imbedded in it would be loosened, tumbled down into the channels, and in flood-time ground up into gravel and spread over fertile ground in the valley. In one province, Ardèche, 70,000 acres, one-eighth its total area, were thus rendered almost worthless by flood deposits. In addition, costly roads, bridges, aqueducts and buildings were undermined and washed away. Large regions, formerly populous, became solitudes, across which it was hard and often unsafe to travel. Meantime rainfall was becoming irregular; floods and droughts alternated; the rapid heating and cooling of the bare slopes caused violent winds; and these, with the sudden changes of temperature, wrenched, so to speak, the moisture from the clouds, causing local floods of terrible fury. * *

"In a mountain region the mischief resulting from clearing steep land, and from unregulated pasturage afterwards are circulative, and, although for three hundred years observing men like

Bernard Palissy, the almost inspired potter of Saintonge, had predicted the calamities of timber famine, the direct damage done by floods became intolerable only within the present century. The great floods of 1840 in the valley of the Rhone, and in 1856 over almost the whole of France, tended to bring matters to a crisis.

* * * Great sums have been spent in such works as retaining dams built across the mouth of the gorges; rows of stone pillars lining the borders of streams, and, at right angles to these, walls of pebbles and rows of trees, and many other expedients, none of which cured the evil; \$24,000,000 was annually spent on roads and bridges, and much of this outlay was made necessary by the gullyng, undermining and covering with debris done by the torrents. * * * But, now, at last, after these costly efforts to cure an evil which grew constantly worse and worse, a step was taken towards prevention. In 1859 a law was passed regulating the clearing of land, and organizing a police for its protection, and in 1860 was enacted the famous *rèboisement* * law which provided for the *rèboisement* or reforesting of the waste lands. * * * Beginning with the trifling sum of 200,000 francs a year for ten years, before the end of that time the success was so marked that all the money that could wisely be expended was readily voted by the Corps Legislatif, and nearly all local opposition vanished. * * * It was estimated that the great flood in the Garonne in June, 1875, did damage to the extent of 300,000,000 francs, besides destroying more than one thousand lives. Careful investigations afterward showed that had the work of *rèboisement* contemplated in the original act of 1860 — and which it was supposed would take one hundred and forty years to finish — been completed, that awful flood would have been comparatively harmless."

These works, so ingenious in their very simplicity, form a net work of horizontal lines, like the alleys of a garden. The green edgings and linings develop themselves among the innumerable sinuosities of the *combes* (valleys), embracing from the rocky beds of the torrents to the very summit of the mountain crests those ravines which were but lately inaccessible, and presented an aspect full of horror. On seeing what has been done, one immediately understands how such a combination should be effectual. Every liquid molecule, so to speak, is seized individually, the thin sheet

* *Rèboisement* literally means re-wooding.

of water flowing down is retarded in its course by a thousand thirsty little plants, by the lines of cultivated herbage, and by the hedges of shoots and trees. It is compelled to tarry a little on each terrace to slake the thirst of the ground, and when it reaches the lower end of a furrow, it spreads itself out on the flattened bed there prepared for it. Stopped at every barrier, it loses its vital force on every hand, and finally, from resting place to resting place, and from descent to descent, it arrives, after a thousand retardations, and still limpid, in the channel which conveys it to the river. The violence of torrents is occasioned by the combination of an infinitude of elements infinitely minute, and the system of extinction consists in extinguishing each of these elements without disregarding one; it is an accumulation of infinitesimal littles. The secondary ravines are blocked up, their minute ramifications are intercepted, the lesser flanks are filled up, and finally there are spread over the soil, completely to diffuse them, the innumerable threadlets (of water), divided and subdivided like the fibres of a root.*

INFLUENCE OF FORESTS ON AGRICULTURE

From what has been said in the foregoing pages the thoughtful reader will readily see the logical tendency of facts, viz. : to prove the close connection that exists between forests and agriculture. The evidences are abundant that a successful agriculture depends on a judicious distribution of forests. Dr. Oswald, in the *Popular Science Monthly*, points to the aridity of the soil all over Spain, Portugal, Southern Italy, Greece, Turkey, Asia Minor and Western Africa, from Morocco to the Nile, and asserts of our country that the States of Ohio and Indiana and the southern portion of Kentucky and Michigan, so recently a part of the great east American forest have even now a greater percentage of treeless area than Austria and the North German Empire, that have been settled and cultivated for more than a thousand years. He believes the central portion of these districts are unproductive from lack of moisture that was once supplied by the forests.

A deep, rich soil is one of the first essentials to successful agriculture. But there are other conditions quite as important—a sufficient and timely rainfall, general distribution and retention of

* From the French of M. Cézanne.

moisture in the soil, and better protection from devastating winds and from injury by early and late frost. These conditions cannot be well and thoroughly secured without a considerable proportion of forest growth distributed throughout cultivated districts. Large forests on mountainous districts and along streams, may favorably affect the plain below, even hundreds of miles distant, by gradually letting off its moisture during summer from the accumulated snow of winter. Yet small groves, at a few miles distant from each other, would add to the productiveness and to the wealth, of even such a favored district. It is not simply the extent of the forest-area of the nation that would render it rich in wood-products, or secure its best agricultural resources, but a thorough and general distribution of forest growth in all parts of the country.*

An eminent English writer,† in speaking of this subject, says:

"When plantations and strips of wood of considerable extent are so arranged as to obstruct the wind in its course, shelter is afforded both to cultivated and pasture land, and in appearance as well as in productiveness the character of the estate undergoes a thorough change. It cannot be doubted, by any one acquainted with the losses which are frequently sustained on high-lying farms from nipping frosts and withering winds, that in cold, late districts shelter is of the greatest value to the farmer. Various kinds of crops are liable at the time of flowering to be seriously injured if exposed to strong winds, and frequently cereal crops, which are just beginning to ripen, suddenly assume a premature whiteness after being loosened about the roots by severe wind storms; the crop is imperfectly developed, and the farmer is the loser. Shelter will, to a very large extent, prevent this evil. Then, at harvest, it has been found that a line of plantations running transverse to the wind, though at the distance of half a mile, has materially diminished the loss from shedding. Along the eastern coast of Great Britain a proper increase of shelter would not fail to add several bushels of grain to the yield per acre; and in Caithness and Orkney, where, simply from the want of shelter at first, ordinary timber trees rarely ever become more than stunted bushes, the increase would be a great deal more. The only way in which either forest or hedge plants can be

* See article in *American Journal of Forestry*, 1892-93, by Dr. A. G. Humphrey, of Galesburgh, Ill.

† Morton's "Resources of Estates," London, 1858.

started into growth in these northern countries is to afford them at once the shelter of a stone wall or earth embankment, and often when their tops appear above the upper surface of the protecting dyke they are cut over by the winds as by a knife. This shows in its extreme aspect the importance of that shelter, which, in all exposed situations, must in a greater or less degree promote the development of crops.

"The value of shelter for pasture stock is no less deserving of careful consideration. It is well known to the veterinary practitioners that cattle grazing in high and exposed situations are generally more predisposed to consumptive and cutaneous diseases than animals pastured on low and sheltered farms. In cold, backward springs the shelter conferred even by a very small plantation is to the sheep farmer in the highland districts of the greatest practical service. On grazings much exposed to withering winds the large number of lambs deserted by their mothers in late seasons, in consequence of a scarcity of milk, is sometimes a severe loss to the flock-master. But it is well known that on hill farms, partially sheltered by growing timber, the percentage of deaths from this cause is considerably reduced. The pasturage, when sheltered even in a very partial manner, is both earlier and more nutritive than if exposed to the full effects of unchecked winds, and in their haunts, flocks rarely fail to indicate the situations which are really benefited by plantations, either near at hand or at a considerable distance. It is a well known principle of animal nutrition that the radiation of heat from the system is greater in a cold than in a warm temperature, and that more food is necessary in the former situation than in the latter to maintain vital heat. If it is practicable, therefore, in the formation of plantations to elevate the mean temperature of any particular district two or three degrees, it follows that its grazing will not only be improved, but that, in proportion as it is consumed, fattening animals will make greater progress than under less favorable circumstances.

It appears conclusive, therefore, that the relation that exists between forestry and agriculture is a very intimate one; and yet, while great exertions are being made to develop the agricultural resources of the country, the inactivity which has long prevailed in respect to the management of timber continues the same and presents, in some respects, an aspect hopeless enough."

"THE FOREST WATERS THE FARM."

The above caption is the English title of a translation of a most interesting and valuable French treatise recently published, and to which we referred a few pages back.* It consists of a series of dialogues between a village schoolmaster and a peasant, who is called Master Peter. The peasant belongs to the ignorant, short-sighted class, who do not believe in forestry and the efforts that the French government is making to stop the devastation wrought by freshets, through the means of reforesting. The proposal is made to replant the hills with trees, and for this it is necessary for the government to assume temporary possession of the pasture and remove the herds. The peasants object. This is the subject under discussion. Master Peter, in the conversations, represents the views of the peasants. The schoolmaster takes the other side and asks a good many questions which set Master Peter to thinking, who, at last, argues himself around to the schoolmaster's way of looking at the subject. The following dialogue taken from the book will be found well adapted to our purpose :

THE FOREST ON THE MOUNTAIN MAKES THE SPRING IN THE VALLEY.

MASTER PETER—I have thought a good deal of what you told me ; good pastures could, indeed, be of great service, but one hesitates to make them because, in dry seasons, there is little value in their products, and besides, inclosures are costly. I should like better the artificial meadow. Your ideas would be excellent if one could always get water. But how can we, without that, change our mode of farming so as to raise stock ?

TEACHER—In order that that may be no hinderance, I can show you how to create springs.

M. P. — Create springs ! God alone can do that.

T. — By knowledge of his laws you may also discover the secret.

M. P. — Ah ! he who had that would be the master of the world.

T. — The government, however, is showing you the means

M. P. — To create springs ?

* *Les Études de Maître Pierre sur l'Agriculture et les Forêts.* (The studies of Master Peter on Agriculture and Forests.) Par M. Antonin Rousset. Translated by the Rev. S. W. Powell. Forest and Stream Publishing Company, New York, 1886.

T. — It has even made a law and voted the money to bring about that very result.

M. P. — How? Such a law has been made, and not a sou. knows of it?

T. — You know it so well that you oppose its execution; it is the law for the *réboisement* of the mountains.

M. P. — *Réboise* to create springs! Plant woods in order to have water!

T. — People plant vines to get wine.

M. P. — The grape yields the wine; but I don't understand about wood or leaves producing water.

T. — Don't you see, then, that the forests are the cisterns in which nature stores the waters that supply the springs?

M. P. — The cisterns! I should have to see that before believing it; but——

T. — If that is all you need to convince you, I can show it to you.

M. P. — I don't ask anything better.

T. — Let us go to the forests of Beaume, and as we go along notice this path. It is steep enough; see how it is washed out? Yesterday's rains have torn out the earth and gravel in such a fashion that, if it is not looked after, it will become impassable.

M. P. — Very true; and it is clear, just as you said the other day, that, since the rain washes away the soil, it is still more likely to carry away manure.

T. — Here we are; let us go into the woods.

M. P. — By no means; the young sprouts are yet loaded with rain and dew. In going through there we should be thoroughly soaked.

T. — Let us follow this deep path.

M. P. — Don't you see these dead leaves in it saturated with water? We should be wet up to the ankle. Let me guide you; we will go around the woods and take the great trench. (Perhaps a drainage canal or trench. — Tr.)

T. — But it is not necessary to go so far to see what we are after. Let us sit down here, at the edge of the ditch, on the moss.

M. P. — On the moss! We might as well sit in a tub. That moss is like a sponge full of water. You speak of fields and woods, but one can see that you know them only by books. Here, let us rest on this big rock. Now, where are those cisterns of yours?

T.— Why, you know them so well yourself that there is no need for me to show them to you. There are cisterns of stone and cisterns of wood, and these are the very ones you were pointing out to me when you told me to notice how, after the rain, the grasses, herbs, moss, leaves and trees hold the water they have received.

M. P.— They also hold the dew; but there is a good deal of difference between them and a cistern.

T.— Less than you fancy; let us reason a bit. When we have neither springs or wells, what do we make in their place? Why, reservoirs or cisterns to hold and keep rain water, which, otherwise absorbed by the soil, evaporates in the air, or, losing itself in the brooks, would remain useless. Now, doesn't anything that hinders water from evaporating or running away answer the same purpose? See how, in contrast with the open fields already dry, the woods, still damp, have saved up the water. Have they not, then, served as cisterns?

M. P.— But what good does the water thus stored in the woods do me, unless I can use it at my pleasure?

T.— If you make a reservoir it ought to be for your personal use, that is plain enough; but in the order of creation, the forests are the cisterns of the earth, intended to supply the needs of all. That water, kept in reservoir, will not remain useless; it will break forth in springs here and there, to enrich and moisten the tilled fields, and it will then be at the disposal of yourself and of others after it has issued from these different places.

M. P.— These are parables of which I don't see the point. The forests hold water better than the open ground; I admit that. But as to your next step, who knows it? Who can prove it?

T.— Experience and study of soils. You have without doubt already remarked the shrinking of your spring during the summer and its increase during the winter. Do you suspect the reason why?

M. P.— No doubt that depends on the depth and size of the underground reservoirs.

T.— Not altogether. After a rain the water absorbed by the earth does not remain near the surface; it soaks in more and more until it comes to an impermeable bed, either of rock or clay. If that obstacle forms a hollow, it originates a subterranean basin; if it slants downward the liquid will follow the slope, and by and by issue in the form of a spring, whose abundance will be propor-

tioned to the quantity of water absorbed, and the time of its flow will be proportioned to that of its absorption. Now the greater part of the pluvial waters that fall upon a bare and sloping field run off into the brooks, because the soil can't at once absorb it all. It is not so in the woods, where the foliage of the trees absorb the violence of the rain. The water, held back by a bed of dead leaves, which hinder both its flow down hill and its evaporation, filters only little by little into the permeable soil; and the foliage, which only gradually drops it, helps this soaking into the soil by moderating the rain and making it last longer. But this is not all. During the winter the soil of the forests, screened by the trees, dead leaves, moss, etc., rarely freezes, and so the snow under the influence of the warmth of the earth, melts slowly and from beneath. You should readily understand how, under these circumstances, all the water is absorbed just as fast as the snow melts. Just the opposite takes place upon a bare field where the snow does not begin to fall until the ground is frozen. If, then, a sudden change of the weather takes place, as, *e. g.*, a warm wind or rain, the snow melts at once, and not being able to penetrate the frozen soil, all the water runs off into the ravines. By reforesting a hill or a mountain you will increase, then, its power of absorption, and the entire volume of water absorbed will, lower down, go either to form a new spring or to augment the one which exists already. Will you not in this way have created a spring? Still further, during the summer the heat evaporates the moisture of the open fields, which the forests preserve, under the roof of their foliage, a freshness always renewed by the dew; thus one sees the springs of those fields that are not protected by any forest drying during July, August and September. That explains to you the regular diminution of your spring during these same months, a thing that would not have taken place if the surfaces above them had been wooded. Finally, the conclusive proof of these facts is that in general the most abundant springs are almost all situated at the foot of wooded hills and mountains. You see how nature has made her cisterns, and has regulated their use so as to fit our needs and to maintain the springs.

M. P. — What marvelous harmony? How few people comprehend the wise foresight of God, and how ignorant of it I myself have been. I wish that all the commune and the council were here

to listen to you. Now I appreciate the woods, and I shall demand that the commune buy land for planting them.

T. — Don't be in such a hurry; the municipal council won't agree with you. Just now I am satisfied to have proved to you, first, the usefulness of the woods; and, second, that when the government makes a law it is not without reason, nor without seeing great advantage in it; and finally, that all things in nature are related to each other, since

The woods hold the water; the water makes meadows;
The meadows the flocks; the flocks the manure;
And the manure the grain;

which is the same as to say, if you wish grain, plant forests! Only if at the first I had, without leading up to it, talked in this way you wouldn't have been willing to listen to me, while now you begin to see that I had some little sense. In studying his work one better understands the Creator, whose all-powerful will has launched the worlds into space, giving them laws which ought to rule them during their whole existence. From the first day to the last the earth should find in itself the means of renewing indefinitely its admirable fecundity. To that end, all the steep slopes should be wooded so as to furnish the water necessary for the irrigation of plants; the foliage of the trees is the manure assigned by Providence to them, and the humus — that is to say, the fertile soil which the forests are always producing — is designed to replace and renew, little by little, the exhausted soils. It can be said, then, that the forests are the cisterns and the feeders of the world. After their destruction we perceive, but too late, the great sum total of their benefits, about which I will talk to you some other time. Just, now, don't forget this wise maxim: "The wooded mountain gives the valley its springs." * * * The woods are like the meadows, we must take care of them if we want to keep them in good condition and desire profit from them; otherwise their destruction is accomplished little by little and almost without our notice.

M. P. — That is all very well in theory, but in practice we must take account of the condition of the small proprietors, who seek to draw from their woods all the revenue they can. If they cut them when young it is so much gained, and the interest of the money repays them. They haven't enough capital to improve them; and, besides, doesn't woodland grow up of itself?

T.— Always the same system — to realize a quick profit, with no forethought for the future. People won't comprehend that a forest cut at twenty years gives a larger return in money and in material than it would if cut four times in periods of five years or twice in those of ten. The interest of the money, do you say? And do you not reckon the enrichment of the soil, its stocking with trees and their extra value both as to quality and quantity, of any account? Alas! consider the difference between the value of a forest kept in good condition and that of one ruined by wrong management. It is as if the sheep were sheared twice instead of once a year; there would be no more wool, and, as it would be of shorter fibre, it would sell for so much less than, notwithstanding the interest of the money used between the shearings, there would yet be a loss. The woods come up again of themselves, say you? Yes; and don't the meadows grow again of themselves after they are mown? but is that a good reason for not taking care of them? The woods come up again of themselves! — a fatal maxim of which those who neglect their woodland avail themselves to excuse the havoc they make and to quiet the alarm of those living in the plains about the dangers of forest destruction. To sum up: Cut your woods with care; reserve the mature trees to re-stock the vacant spaces or else sow those spaces directly; take away what you cut at once, so as not to harm the young shoots, and, lastly, keep away the flocks, and you will have fine forests. The bad methods of management followed up to the present time have caused the deforesting of which there is complaint. The output of forage crops, of manure and of grain is diminished in proportion. Every one thus suffers from the greed and selfishness of these unwise proprietors, who ruin their woodland under the pretext of speculation, and for the sake of a temporary improvement in their finances prepare ruin for their children, who, too late, will in their own persons afford a proof of the truth of this maxim: *A country without wood is a house without a roof; no peace there! Sun, wind, rain and cold keep every one in a turmoil.*

M. P.— The parliament exists no longer, but to make up for that, the Durance,* and especially the mistral,† have redoubled their violence. I don't believe your hedges of maize and cane can stand before it very long.

* A river in Provence, liable to frequent freshets.

† A cold north-west wind.

T. — That is where you are mistaken; a barrier of plank or a wall might be swept away or upset, while these hedges remain fast. Opposing to the wind an elastic obstacle, they overcome its force by dividing it. When a tempest beats upon the denuded flanks of a mountain it will shake the rocks, catch up the stones, and overturn isolated trees; far from calming it, the obstacles redoubling its fury, it will rebound and form in the valleys those waterspouts which devastate the crops. But when it strikes a wooded slope each tree, each branch, will bend under the force of the wind, and will check its force by its elasticity; the hurricane will be sifted and absorbed by the woods, so that there will be no counter-blast in the neighborhood. Upon a plain the effect will be the same; a screen of trees will suffice to check and prevent the ravages of a violent wind. You know how the great currents of air cause rains, storms, and abrupt changes of temperature so hurtful to crops. Very well, the woods, whether located upon the plain, the shore of the sea; upon the summits or the slopes of the mountains, are the only means of preventing these sudden changes from cold to heat. It is not without good reason that nature has placed in the plains and valleys a rich and delicate vegetation; the mountains should afford them shelter, and the slopes, originally wooded, should furnish it abundant springs, and at the same time give it protection from the fury of the winds, and whenever cultivation and clearing have laid bare the slopes, the valleys have most severely felt the effects of the change. Nothing is so good as the coppice or the grown timber as a shelter for the cultivated fields, especially against the winds.

FOREST DESTRUCTION AND ITS RESULTS.

We have cut and burned our forests with reckless wastefulness. It would seem as though our great anxiety had been to get rid of them as soon as possible. We have consumed our patrimony with spendthrift prodigality. Never was a land more magnificently supplied with timber adapted to the manifold uses of civilized and industrial life than was our own at the beginning of its settlement. Now little of it remains, and at the present rate of consumption in a few years it will be practically extinguished.* In view of the

*The entire annual consumption of wood for building and manufacturing purposes is estimated but little short of 30,000,000,000 feet. This of itself must show the enormous destruction of forests going on in the United States and the serious result a loss of its timber must have upon its future welfare.

facts we may well ask if something cannot be done to stay the process of destruction.*

Of all quarters of the world America was originally the most thickly wooded with primeval forest, "but it is now doubtful," says Marsh, "if any one State of the United States, except, perhaps, Oregon, has more timber than it ought permanently to preserve." Our white pine is practically gone and our yellow pine will, at the present rate of cutting, disappear in a few years. Said the celebrated botanist, Hooker, when he made a trip through the United States, a few years ago: "The devastation of the forests in California is proceeding at a rate which is utterly incredible except to an eye-witness;" and now the California newspapers tell us that there will soon be an end of the far-famed redwood forests of that State. There are no fewer than nineteen lumber companies now engaged in cutting down the "big trees," and all the mills are in constant work, as the demand for the wood is practically unlimited. The country will, therefore, be cleared in a few years, for nobody makes even an attempt at replanting.†

"It is certain," says Marsh, "that a desolation like that which has overwhelmed many once beautiful and fertile regions of Europe awaits an important part of the territory of the United States, unless prompt measures are taken to check the action of destructive causes already in operation. * * * Fortunately, some of the American States still retain the ownership of great tracts of primitive woodland. The State of New York, for example, has in its northeastern counties a vast extent of territory * * * where the soil is generally poor and the value of the land for agricultural purposes, therefore, very small, and few purchases are made for any other purpose than to strip the soil of its timber. * * * It is desirable that some large and easily accessible region of American soil should remain, as far as possible, in its primitive condition, at once a museum for the instruction of the student, a garden for the recreation of the lover of nature, and an asylum where indigenous tree and humble plant that loves the shade, and

* See Report of the U. S. Commission of Agriculture, 1883.

† The report of the California State Board of Forestry puts the limit to which redwood promises to last at from seventy-five to one hundred years. The waste, it says, has been enormous. The total consumption for 1885 is estimated at 215,000,000 feet, board measure

fish and fowl and four-footed beast may dwell and perpetuate their kind in the enjoyment of such imperfect protection as the laws of a people jealous of restraint can afford them. The immediate loss to the public treasury from the adoption of this policy would be inconsiderable. The forest alone, economically managed, would without injury and even with benefit to its permanence and growth soon yield a regular income larger than the present value of its fee. The collateral advantages of the preservation of these forests would be far greater. Nature threw up those mountains and clothed them with lofty woods that they might serve as a reservoir to supply with perennial waters the thousand rivers and rills that are fed by the rains and snows of the Adirondacks, and as a screen for the fertile plains of the central counties against the chilling blasts of the north wind, which meet no other barrier in their sweep from the Arctic pole. * * * The felling of the Adirondack forests would involve, ultimately, for northern and central New York consequences similar to those which have resulted from the laying bare of the southern and western declivities of the French Alps and the spurs, ridges and detached peaks in front of them."

Besides the destruction of timber by fires and by the premature cutting of trees, and heedless waste of all sorts, the annual consumption of timber for legitimate business purposes is far greater, probably twice as much, as its annual production by growth. A rapidly growing population and an increasing demand for wood in mechanical industries makes, every year, greater and greater demands on our forests. Take the matter of railroad ties for example. The large and rapidly increasing demand made upon our forests in supplying timber for ties alone is shown by Prof. Eggleston in his report on forestry, issued in 1884, by the following facts.

There are now in use in this country about 150,000 miles of railroads, which have required 396,000,000 ties — all the wood supplied by 3,390,000 acres, an area larger than that of the States of Rhode Island and Connecticut. Estimating that ties need to be renewed on an average once in seven years, there must be drawn from the forests annually 56,571,428 ties, requiring the timber growing on 565,714 acres. Allowing thirty years as the time necessary to produce trees of proper dimensions for ties, it will require 16,971,420 acres of woodland to be kept constantly growing as a kind of railroad reserve, in order to supply the annual needs of existing roads.

This constitutes an area larger than the States of New Hampshire, Vermont and Massachusetts combined, or of the States of New Jersey, Maryland and Delaware, with the addition of Connecticut. It is more than four per cent of the total area of woodland in the United States, exclusive of the territories, and three per cent of the area of the States and territories together. With the rapid extension of our railroad systems these figures will be proportionally increased.

Until recent years, it has seemed to most people as though the supplies of wood could never come to an end, and that our natural forest wealth formed a kind of universal and inexhaustible mine, which it would be impossible to exhaust. Many founding their opinions upon the ground that from the earliest period the world has always easily found all the wood necessary for its use, and this without having to depend upon the discovery of new forests, would pretend that it was ridiculous to borrow trouble so far ahead, as, in all events, there would be provided, in some way or another, the means of avoiding the dangers that they considered as only imaginary. While we are not alarmists and are not of those who predict an impending forest famine, and an immediate precipitation of the direful consequences that have overwhelmed tree-stripped countries, there, nevertheless, exists a most threatening danger, which has already been often pointed out with energy, and against which the general welfare requires us to adopt on every side the most effectual and decisive measures, that should be executed with activity and perseverance.

Let us see how our supplies stand. We have, as our only data, the census of different periods; and the returns of 1880 show, that of our States and territories, nine had reduced their woodlands to below ten per cent; five to between ten and twenty per cent; eight to from twenty to thirty per cent; eleven to from thirty to forty per cent; and four to from forty to fifty per cent, when this census was taken. In ten States of the south and southwest, the proportion was fifty per cent or more, and in the whole United States, the woodlands occupied thirty-five per cent of the whole reported area. In the State of New York the census shows the amount of land in farms; distinguishing the amount in cultivation, in pasturage, in woodland and in waste land (the latter being old fields, land on which no wood is growing), and lands not included in the preceding classes. Leaving out Kings and New York

counties, which have no importance in forestry, we find that six counties had in 1880, less than ten per cent of woodlands; twenty-six counties from ten to twenty per cent; seventeen counties from twenty to thirty per cent; four from thirty to forty per cent, and only five had more than forty per cent of their surface wooded. These proportions are (excepting the last) below the limit which long experience in older countries has proved necessary for their agricultural interest and the public welfare.

The opinions expressed by some, upon the question of forest preservation, appear to indicate a belief that it is of a local character, affecting only the Northern Wilderness and the waters that flow from it (a sufficiently important matter of itself); and some narrow down their interest to that part of the region that drains into the Hudson, or from which the waters can be brought into the Erie canal. When rightly understood, it will be found that this is a very broad subject, affecting not only the region included within the limits of the Adirondack Forest, but vitally concerning every county in the State

The practical significance of the facts cited in this report is too obvious to need pointing out in detail. They teach the importance of preserving our forests to save them from destruction by fire and from the reckless use of the lumberman's axe. It would seem superfluous to point to the people of New York the folly of killing the hen that lays golden eggs. Our forests are a trust to us, to be administered upon as uprightly, as sacredly and with as much regard to the rights of those who come after us as any other trust committed to our hands. We have no right to squander nor to misuse that trust. Forestry teaches how to use forests without abusing them. It claims that a wise management of the forest areas, and the maintenance of a due proportion of them, would insure excellent returns for the labor expended and the capital invested. As to tree-planting and reforestation, much might be said to show its advantages. Yet it cannot be expected that forest culture will be carried out, on any large scale, until the public can be convinced that it will prove to be pecuniarily profitable. In other words, a general adoption of a system of tree-planting and timber-growing will depend on the answer to the question: Will it pay? It can be easily shown that in the broader sense it will "pay," and pay abundantly; but this utilitarian generation demands speedy and large cash dividends.

As the State cannot, of course, undertake to control the management of private woodlands, it is to the owners of the land, themselves, that we must look for the principal portion of our future forest products, and the sooner this is realized and made the basis of intelligent action on their part, by carefully preserving what they have and providing more, the better it will be for them and for those who come after them. It is a natural and noble instinct in man to seek to promote the welfare of his family, and it is no mean motive in him to toil through life in order that he may leave an estate for their inheritance. Now, if by careful management and judicious tree-planting, even on a small scale, a man can so improve his farm that it will be worth much more when he leaves it than it would have been without judicious planting, is he not securing the very object of his laudable ambition?

There has already much been done throughout the Eastern States in the way of forest culture, with satisfactory results; and it has been demonstrated that forests may be grown with comparatively small expense and with profit. There are few soils so unsuited to vegetation, or the raising of crops, that they cannot be devoted with profit to the cultivation of forest trees. There are large tracts of land in the forest regions of this country, or where forests, within the memory of man, have been abundant, which are now lying entirely waste. No farmer would be wise in selecting his arable land for the plantation of a forest; for the investment would be an injudicious one and would be attended with loss. But it is these waste places which can be so utilized, we believe, as to prove a sound investment. Mr. Higley says:

"In the New England and Middle States, forests may be grown with little expense and trouble. Fields worn out, and abandoned or cleared lands not fit for agricultural purposes and yielding little or no pasture, can often be renewed by simply protecting them from browsing cattle and fires. Trees spring up naturally and thickly, and often of good variety. A little expenditure of time and money in sowing or planting the seed of valuable timber trees will insure the growth of a crop that is sure to yield a good return. A farming country should not have less than twenty-five per cent of its area in woodland. In general, outside of the prairie States, this proportion can be set aside from lands of little or no real value for agricultural purposes. There is hardly a farm, in this

portion of the country, of one hundred acres that will not be greatly augmented in value by devoting this proportion to the cultivation and maintenance of woodland, and when farmers come to realize this fact they will no longer look upon the wood-lot as of little comparative worth, ready to be cleared on the first demand, but will place a just estimate upon its value and will discern its influence on the rest of the farm in protecting from destructive winds; in holding moisture against the droughts of summer; in modifying the extremes of heat and cold; in rendering the fruit crop surer, and in being, to a certain extent, the conservator of health while it yields abundantly of its product for the farm."

We also quote on this topic the words of Mr. B. E. Fernow, chief of the United States Division of Forestry:

"Most of the methods recommended and described in American newspapers for planting forests presuppose that the ground to be planted is arable, or at least workable with the spade. This may be all right for the prairie States, yet there are probably on every farm in the mountainous regions more waste places than anywhere else, that will never pay to get the stones out — that will not grow any grass of value and that defy all cultivation. There are others which are too wet and on account of their nature drainage for agricultural use is impossible or unprofitable; others again, which on their dry, shifting sand will not bear any crop. These are the very places to which in time the forest in every well-settled country will be more or less confined, the better portions being needed for farming purposes; and, fortunately enough, not only can such places be made to bear forests, but, being so used, they are improved and often after some time gain in value, even for agricultural crops. To find out cheap methods for covering such places with a tree-growth is, therefore, a task not to be neglected."

In this work of reclaiming waste places every owner of a few acres may take a hand. "Trees are growing while men are sleeping." The farmer who in the intervals of other work plants a few trees, though he may not be engaged technically in the work of "reforestation," is conferring a great benefit on his land. Trees should be planted on rocky hillsides, sandy barrens, along the brooks and water-courses, around the springs and by the roadside. It costs little to try the experiment, and in the results, restoring vegetation to sandy, waste places, affording shelter to cattle and

preserving the present if not restoring the lost water-supply to the farm, in all this, not to speak of the increased attractiveness that the trees would lend, the planter will be amply rewarded. The effort to establish the celebration of a day known as "Arbor Day" and the renewal of the old and commendable custom of planting memorial trees and groves has awakened much interest in trees and tree culture, besides being accompanied in some parts of the country with valuable economic results.

It is in the power of this State, by the methodical and systematic management of its own forests, to set a good example and exert a wide beneficial influence in the direction of forest preservation and forest culture. Here the State of New York occupies a remarkably advantageous position. It is one of the few, if not the only one, of the older States of the Union that owns any considerable tract of original wild forest land. It has a possession not to be lightly esteemed nor squandered. Already much has been done by favorable legislation and the establishment of a commission to make that legislation effective, towards accomplishing the purposes sought. It cannot be questioned that a good beginning has been made. It only remains to perfect the laws, to establish from time to time the proper machinery for their fulfillment and to employ the necessary methods for enlightening and instructing the public upon the questions and problems involved in forestry. In the solution of these questions and problems (to allude again to the suggestion of Comptroller Chapin) no State in the Union has such an admirable opportunity as has the Empire State to lead the way.

THE CATSKILL PRESERVE.

During the past winter the Commission detailed Inspector Charles F. Carpenter to make a thorough examination of the Catskill Preserve. His report, presented herewith, is based on a careful personal inspection of that region :

REPORT OF INSPECTOR CARPENTER ON THAT PORTION OF THE FOREST PRESERVE INCLUDED WITHIN THE CATSKILL DISTRICT.

The Catskill region includes portions of Greene, Ulster, Sullivan and Delaware counties. In location it occupies a large part of the south-eastern corner of the State. The valley of the Hudson river forms its eastern border. The rich agricultural lands of Orange county, and the wild mountain regions of Pike and Wayne counties of Pennsylvania coming down to the Delaware river, form its southern boundary. Broome, Chenango, Otsego, Schoharie and Albany counties, including a rich agricultural section, principally devoted to hop raising and dairy products, bound the Catskills on the west and north. From the Hudson river the mountains are distant about nine miles, and occupy a position very nearly parallel with its course.

The central point of this region lies somewhere in the town of Hardenburgh, in Ulster county, in about latitude 42° north and longitude $2^{\circ} 30'$ east from Washington, and about 100 miles distant from Albany and sixty miles from New York city. A circle about fifty miles in diameter struck from this point will include nearly the whole of this Catskill mountain region, with, however, the addition of an arm including the towns of Hunter, Jewett, Windham and Cairo, in Greene county, projecting north-easterly, and another arm including the southern-most towns of Sullivan county, forming a projection due south from the center of the circle, comprising altogether an area of about 2,500 square miles.

The contour of this mountain district is extremely diversified, possessing every feature known to hill and valley ; on the eastern face of the Catskills the slope is generally towards the north and east, and the streams taking these directions find their way to the Hudson river. There is a large interior water-shed, hemmed in by a circle of high peaks and mountain ranges. Starting from a point in the Plattekill Clove, the dividing ridge on the south is marked

by Sugar Loaf mountain, Plateau mountain, Hunter mountain, Big Westkill mountain, North Dome, Mount Sheril, Vly mountain, Bloomberg mountain, Irish mountain, Bald mountain, Mount Utsayantha, Mine mountain, Woodchuck mountain, till the peaks fall away and form the Schoharie hills. Returning to the same point in the Plattekill Clove, the dividing ridge includes High Peak, Round Top, Haines's Falls divide and Stoppel Point. From this last the mountain ranges, with well-defined crests, have been made the dividing line between the towns of Cairo and Durham on the north, and Jewett and Windham on the south in Greene county, terminating at Mount Pisgah at the south-east corner of Schoharie county. From this point the range continues to waste away, finding its last eminence in Leonard hill, near the center of Schoharie county. From the slopes of this interior basin the waters of the Schoharie creek take rise and gather strength and volume for their long circuit, and finally, after mingling with the waters of the Mohawk, and in turn with the Hudson, find themselves, when opposite Saugerties, only ten miles from their starting point. The waters coming from the southern slope of the mountains, on reaching the lower slopes, take an easterly course and flow into the Hudson river; those from the general western slope form the several branches which together make up the headwaters of the Delaware river. The Hudson river slope is by far the greatest, occupying as it does a large portion of the three counties of Greene, Ulster and Sullivan. Next in importance is the Delaware slope, and wedged in between the two is the basin of the Schoharie creek. These two main slopes, and the interior basin, are divided into innumerable smaller systems, but the streams from them all find each their own channel at last, and though they twist and turn in their tortuous course, traversing many a mile, still the general course is towards the outlet of the water-shed of which they form a component part, and sooner or later their waters mingle, forming one of the numerous kills in which this region abounds.

There are very few well-defined mountain ranges; the impression to the casual observer being that of a great number of peaks huddled together. Still, by a little closer examination, they can be made to conform somewhat to systematic lines. Viewed in the broadest sense, they can be considered as the foot-hills of the higher Alleghanies, and as such, a part of the great Appalachian system.

which forms the Atlantic slope of the continent, and extends nearly parallel with the coast line from Nova Scotia to the Gulf of Mexico; of which system the Adirondack mountains do not form a part, they being of the Laurentian system.

The Catskill region is made up of rough mountain and deep valley, the very inaccessibility of which, together with the unkindly nature of the soil, has been its only salvation. Occupying but a patch on the broad domain of the whole State, insignificant in proportions when compared with the Adirondack region, thinly clothed with a forest of hard wood timber only, but maintaining an enviable position with reference to, and filled with resources commanding an active market at the shipping port of the world, this little patch is a mine of wealth and a source of vast income, both to the State and to individuals. It is, therefore, worthy of a thought how best not to waste these resources. Walton Van Loan, of Catskill, in his published Catskill Mountain Guide, gives the high peaks of the Catskills, which, when arranged according to the counties in which they are located, will convey a fair idea of their comparative elevations. The base of comparison is tide water in the Hudson river at the foot of the mountains.

HIGH PEAKS OF THE CATSKILLS.

Greene County.

NAME OF MOUNTAIN.	Town.	Elevation, in feet.
Hunter	Hunter	4,052
Black Dome	Windham and Jewett	4,004
Thomas Cole	do	3,975
Black Head	Cairo and Windham	3,965
Big West Kill	Lexington	3,900
Vly	Halcott and Lexington ...	3,888
Plateau	Hunter	3,855
Sugar Loaf or Mink	do	3,807
Kaaterskill High Peak	do	3,800
Twin	do	3,650
Indian Head	do	3,581
Windham High Peak	Windham and Durham ...	3,534
Round Top	Hunter	3,500
North	do	3,450
Huntersfield	Prattsville	3,300

HIGH PEAKS OF THE CATSKILLS — *Greene County* — (Cont'd).

NAME OF MOUNTAIN.	Town.	Elevation, in feet.
Mount Richmond	Ashland	3,202
Colonel's Chair	Hunter	3,200
Plattekill	do	3,200
East Kill	do	3,190
Jewett	Jewett	3,025
Tower	do	2,931
Mount Pisgah	Windham	2,905
Mount Hayden	do	2,900
South	Hunter	2,500
Clum Hill	do	2,372
Pine Orchard	Catskill	2,227

Ulster County.

Slide	Shandaken	4,220
Mount Cornell	do	3,920
Graham	Hardenburgh	3,886
Peakamoose	Denning	3,875
Table	do	3,875
Wittenberg	Shandaken	3,824
Big Indian	Hardenburgh	3,800
Panther	Shandaken	3,800
Eagle	Hardenburgh	3,566
Overlook	Woodstock	3,300
High Point	Olive	3,100
Mount Garfield	Shandaken	2,650
Tysten-Eyck	Woodstock	2,600
Mount Sheridan	Shandaken	2,490
Summit	do	2,482
Mount Tobias	Woodstock	2,000

Delaware County.

Bloomberg	Roxbury	3,456
Mount Pisgah	Delhi	3,425
Mount Utsayantha	Stamford	3,365
Bramley	Delhi	2,850
Mount McGregor	do	2,550

These mountain ridges divide this region into innumerable small water-sheds, the gatherings from which contribute to comparatively few large streams. The Schoharie creek water-shed, principally in Greene county, is, in reality, made up of four or five smaller ones, being

divided by spurs from the main ridges. There is a divide between the headwaters of the Schoharie creek and the West kill, the two streams coming together at Lexington; another divide starts at Stoppel Point and ends at Jewett Centre where the waters of the East kill join the Schoharie creek; another divide starts at Black Head mountain and takes nearly a due east course ending near Prattsville, where the waters of the Batavia kill join the Schoharie creek; another divide starts from the main range at the south-east corner of Schoharie county and taking a course about parallel with the last divide continues on into Delaware county; the Schoharie creek breaks through this ridge near Dewasego Falls in Schoharie county, and below this the Manor kill enters the Schoharie near Gilboa in Schoharie county. Innumerable smaller streams come in from both sides of the main stream.

The eastern slope draining into the Hudson river direct has four principal water-sheds. The ridge between the first water-shed, drained by the Catskill creek, which enters the Hudson river at Catskill, starts a little west of that village and follows nearly a straight line to the south-east corner of the town of Jewett at Stoppel Point mountain, thence it follows the main range to where that runs out in Schoharie county. The Kaaters kill drains the country immediately south of the Catskill water-shed and has for its southern boundary the ridge back of Saugerties, which pursues a north-east course for a distance of about five miles, then turns north-westerly to strike High Peak, Round Top and the border of the Kaaterskill Clove at Haines's Falls. South of this water-shed is the great water-shed of the Esopus creek, the north boundary of which starts in the Plattekill Clove, on either side of which within a few rods of each other are the sources of the Platte kill, a branch of the Esopus creek, and the fountain head of the Schoharie creek, the waters of which take opposite directions, each in time arriving at the same point in the Hudson river. From the summit in the Plattekill Clove the divide leads over Sugar Loaf mountain, to the summit between Roaring kill going to the Schoharie creek, and the Beaver kill going to the Esopus, thence by many twists and turns it finds its way to the Hudson near Kingston. The Beaver kill coming from the Plattekill Clove in Greene county joins the Esopus at Glenerie; the Saw kill rising in Cooper lake in the town of Woodstock, Ulster county,

joins the Esopus above Kingston. Another Beaver kill rising near Sugar Loaf mountain in the town of Hunter, Greene county, within a few rods of the source of one of the headwaters of the Schoharie creek, joins the Esopus at Phœnicia. The Stony Clove creek, in the town of Shandaken, Ulster county, rising within a few miles of the village of Hunter, in Greene county, furnishing water power for an important industry, also joins the Esopus creek at Phœnicia. The Smith Bush kill rises in several diminutive ponds near the summit between the Schoharie creek water-shed and the Esopus creek water-shed, and but a few rods from where the waters of a branch of the West kill rise, flows through Bushnellville near the southerly line of the town of Lexington, Greene county, and enters the Esopus creek at Shandaken in Ulster county. Each of the above enumerated streams has a water-shed of its own, of a greater or less magnitude and extent, the larger of them being those drained by the first mentioned Beaver kill and the Saw kill. The Rondout creek drains the water-shed on both sides of the Shawangunk range of mountains; the Rondout proper lies on the north-westerly side of the range, and the Shawangunk kill, heading within a few miles of Port Jervis, in the south-westerly corner of Orange county, lies on the south-easterly side of the range. A ridge of low hills starts near the junction of the Shawangunk kill with the Wall kill forming with the Highlands of the Hudson a narrow and abrupt water-shed drained by the Wall kill. The junction of the Shawangunk kill and the Wall kill is but a few miles north of the south line of Ulster county.

Sullivan county, with the exception of one-half of the town of Neversink, as a part of the Rondout creek water-shed, drains into the Delaware river. From the south-west corner of the county the Delaware river, which forms its southern boundary, flows in a south-easterly direction to Lackawaxen, and from this point to the south-east corner of the county the course of the river is nearly due east, continuing this direction to Port Jervis where it takes a sharp turn to the south-west, following the trend of the Shawangunk range of mountains. At this point the Neversink river joins the Delaware, flowing across the entire width of Sullivan county in a south-easterly direction. The divide between this water-shed and the water-shed of the Shawangunk kill and the Rondout creek follows the crest of the Shawangunk mountains to Wurtsborough, and,

thence along the height of land bordering the Neversink river till the headwaters are reached near the north boundary line of the town of Denning, in Ulster county. The divide between this water-shed and that of the Mongaup river follows a line nearly parallel with that between the Neversink river and Rondout creek, but reaches its highest point considerably south of the headwaters of the Neversink, this point being near the north-east corner of the town of Liberty, in Sullivan county.

From this water-shed to that of the two branches of the Callicoon creek the intervening distance is divided into several small water-sheds, all south of the south line of the Hardenburgh Patent, with the single exception of that of Ten mile creek, which extends north to about opposite the center of the east line of the town of Delaware, Sullivan county. These last are all directly tributary to the Delaware river. The water-shed of the two branches of the Callicoon creek includes a section embracing the towns of Delaware, Callicoon and the west one-third of the town of Liberty, both branches of the creek rising within a few miles of each other near the south line of the town of Rockland, Sullivan county. A mountain ridge starts at the junction of the Beaver kill with the east branch of the Delaware river and marks the southern boundary of a watershed; another ridge starts from near the same place, and, bearing to the north-east, passes into the south-western portion of the town of Hardenburgh; another ridge starts from the summit near Parksville, in the town of Liberty, Sullivan county, and joins the second ridge in the town of Hardenburgh, near Tunis lake. The territory embraced within these limits is the watershed of the Beaver kill and its main branch, the Willewemoc. The east branch of the Delaware river has for a watershed the territory included between the north bounds of the Beaver kill water-shed, the east bounds of the Esopus creek and Schoharie creek water-sheds, and the crown of the ridge between the east branch of the Delaware river proper. The water supply in the streams and rivers is subject to the same fluctuations observed in other sections which have been partially denuded of their original timber growth and have been more or less wasted by the action of fire. Those who depend on the water in the streams to drive the machinery of their mills and factories begin to appreciate the fact that the available summer supply is steadily on the decrease. In conversation with manufac-

turers in various parts of this region and with people who have been long resident on the banks of the streams or in their immediate vicinity, I have heard convincing testimony as to this failure through the dry season. At a large chair factory at Chichesterville, on the Stony Clove creek, one of the officers of the company informed me that twenty-five years ago, when they first located in the place, their factory could be run entirely by water-power; now, and for several years past, they have been obliged to supplement it by the use of steam, the water having dwindled away to such an extent as to furnish through the summer months only one-half the power it formerly did. He likewise complained of being troubled with floods in the spring and fall and, naturally enough, concluded his whole trouble came from cutting off the timber on the watershed of the stream, particularly at its source, and also from allowing disastrous fires to burn up the muck-soil and leaf-mold, so that nothing remained on the surface to hold back the water of rain storms, which, rushing off from a denuded and steep water-shed, caused the sudden and damaging floods in the stream. Another manufacturer, in the town of Wawarsing, Ulster county, whose factory is located on the Vernooey creek, a branch of the Rondout creek, who uses water-power from eight to nine months in the year, has used steam-power in connection with this since 1863, when the summer supply began to fail. Previous to that he used water-power the year round. He attributes the change in the supply to cutting off the timber on some swampy pieces of land, which were filled with standing water while the timber grew there, but which dried out after it was cut down and has been dry through the summer months ever since. Examples could be multiplied all through and around this region, but inasmuch as all seem to be agreed as to the cause of the decrease of the water-supply in the dry seasons and invariably attribute it to cutting off the timber-growth, there is little need of repeating or recording them.

The Catskill region abounds in streams of large volume and rapid descent, furnishing power to a large number of manufacturing concerns, which draw their raw material, in most part, from the forests which clothe the mountains. A continuation of these industries depends, to a large extent, on the continuance of the water supply, and that in turn depends upon a judicious management of the forests, of keeping out fires and allowing such sections as have once

been cut over to grow up with a new forest covering. At Chichester-ville a stream comes out of a clove to the west of the main stream. The water-shed of this stream was cut clean of its timber several years ago, since which time it has grown up pretty well with small stuff, and the summer flow of this stream is greater than that of the main stream, which is a convincing fact in regard to the action of vegetation on the retention and delivery of the rain-fall.

The Hudson river receives the waters of four large and important streams, which find their rise in the Catskill mountains. The Schoharie creek, made up of the combined flow of the East kill, West kill, Batavia kill and the Manor kill, flows down a steep and rugged valley, takes almost a due north course, and finally empties into the Mohawk river at Fort Hunter, in Montgomery county. This stream in the mountain regions furnishes water power for numerous manufactures, and in early times, before the hemlock timber was all cut off, many tanners prosecuted a thriving and lucrative business by aid of its water power. The valley is occupied for the greater part of its length as a farming section and through the towns of Hunter and Lexington, in Greene county, a large summer population finds accommodation in the many large hotels and boarding-houses scattered along its banks. Indeed so much attention is paid to the business of entertaining summer boarders that the farms show many signs of neglect. The land along the stream is for the most part poor and stony and the sides of the valley steep and very abrupt in places. The remaining three of the four streams going to the Hudson river reach it direct. Of these the Catskill is the furthest north; the stream proper rises in Schoharie county and flows in a south-easterly direction, being re-enforced first by the Potuck creek, coming from Albany county, and second by the Kaaterskill, rising in the town of Hunter, Greene county. It reaches the Hudson river at Catskill village, through which it flows. Comparatively little manufacturing is done on this creek or its branches.

Next in order is the Esopus creek, which for length, strength and utility bears off the palm; manufacturing establishments of all description line its banks, and prosperous, thriving villages occur at frequent intervals. The branches of this stream are rather unimportant in size, and come in mostly from the north. The stream rises in the Big Indian hollow, in the town of Shandaken, Ulster

county, flows first northerly till the main valley is reached, then turns sharply toward the east, pursuing this course to Shandaken, where it gradually assumes a south-easterly course, following this direction to near the village of Stone Ridge, in the town of Marbletown, where it takes a sharp bend to the north-east and continues thus to the city of Kingston; here its course is again changed more to the north to near the village of Saugerties, where, turning due east, it finds its way to the Hudson. The main tributaries of this stream are the Saw kill, which joins it about three miles north of Kingston, and the Platte kill, which joins it at Glenerie, forming a part of the division line between the towns of Kingston and Saugerties. Following the Esopus, in order, comes the Rondout creek, taking its rise in the high mountains near the north-east corner of the town of Denning, Ulster county. Its course is first south-west-erly, traversing a portion of the north-east corner of Sullivan county, then, turning a sharp corner, it passes out of Sullivan county, in a south-easterly course until its junction is made with the Sandburgh creek; here another sharp turn to the north-east is made, which course it pursues till it empties into the Hudson river at Rondout. This stream is re-enforced by the waters of the Shawangunk Kill and the Wall kill which drain the section lying south-east of the Shawangunk range of mountains.

Down the valley of the Rondout creek the Delaware and Hudson canal has been built, affording slack water navigation from the Hudson to the Delaware, and transportation for the cement manufactured through that and the adjoining valleys, and the coal used in burning it. This is the last of the large streams coming from the Catskill, whose waters go to the Hudson river; the water-shed of the Shawangunk kill being the Shawangunk range of mountains, which meeting the high ridge bordering the Neversink forms an impassable barrier, and caused the Delaware river at Port Jervis to make an abrupt turn toward the south. If this range had not existed, the Delaware river would have been a tributary of the Hudson, finding its outlet through the valley of the Rondout creek. The Shawangunk grit proved too much for the erosive effect of water, even when thrown against it in as great a volume as that of the Delaware. The remainder of the Catskill region is drained by the Delaware river, this embraces the western and south-western mountain regions, and includes the counties of Sullivan and Delaware.

Starting from the southern end of the north and south dividing ridge, the first stream of importance is the Mongaup river, which takes its rise near the village of Parksville in the town of Liberty, Sullivan county, flows in a southerly direction across the county, and enters the Delaware at Port Jervis. This is a stream of magnitude and importance, draining a long, narrow section of territory, mostly a wild and sparsely settled country, hilly and rolling in its nature.

In the town of Fremont two unimportant streams come to the river, one at Hankins and the other at Basket near the south-west corner of the town; both rise in the northern part of the town and flow in a south-westerly direction. They are known, respectively, as Hankins creek and Basket creek. Fremont is the south-western town of the county. Beyond this the east branch of the Delaware river joins the main stream. This branch rises near the north line of the town of Roxbury, Delaware county, follows a nearly due south course, being supplied from the east by the Batavia kill which drains the eastern side of the town of Roxbury; the Bush kill rising near the north bounds of the town of Halcott, Ulster county; Dry brook, rising near the south-east corner of the town of Hardenburgh, Ulster county, and joining the Bush kill at the village of Arkville, in the town of Middletown, Delaware county; and lastly, the Beaver kill, with its branch, the Willewemoc, which rises in the south-western portion of the town of Denning, Ulster county, crosses the north-west corner of the town of Neversink, Sullivan county, and thence flowing in a westerly course across the town of Rockland, Sullivan county, it joins the Beaver kill near the village of Westfield Flats in the south-western part of the town. The Beaver kill proper rises near the middle of the southerly boundary of the town of Hardenburgh, Ulster county, flows in a westerly direction and passes out of the town at the north-west corner, then runs in a south-westerly direction along the boundary line of the town of Rockland, in Sullivan county, to its junction with the Willewemoc. At this point it makes a sharp turn toward the west in the general course of the Willewemoc, to its junction with the east branch of the Delaware river. The Beaver kill, with its branch the Willewemoc, forms an important water power. Its sources are among the wildest and densest forests of this region, and not far from the headwaters of the Esopus creek and the Never-

sink river. Near these sources is a group of mountain peaks among which are Big Indian and Double Top. From this group the streams flow to the four cardinal points of the compass. The rivulets that form Dry brook flow away from them to the north and reach the Delaware. Pigeon brook flows south to the Never-sink and on to the Hudson. Elk Bush kill flows east to Big Indian Hollow, joins the Esopus and thence to the Hudson. The springs supplying Tunis lake rise in this group and follow down its western slope to issue at its foot, becoming in time the Beaver kill whose waters go to the Delaware river. Thus the circuit of the watershed is completed. The Hudson receives by far the greater portion of the water, and would have received all but for the interposition of the flinty range of the Shawangunk mountains, which threw its barrier across the path of the Delaware and forced it to seek an outlet through another channel, and to traverse thrice the distance it would have had in a straight course to the Hudson.

Ulster and Greene counties cannot lay claim to any great number of lakes or ponds, the conformation of the land favoring more the formation of streams. Such as there are have been eagerly sought out and purchased by private parties, who control and use them. They are scarcely deserving of the name of lake, which term, however, has a different signification in different localities, and of itself is no criterion of the size or magnitude of the body of water. Back of the Catskill Mountain House, in Greene county, are two lakes, known, respectively, as South lake and North lake (on the maps as the Catskill lakes), the first covering thirty-three acres and the second twenty-six acres, being at an elevation of over 2,200 feet above tide-water. They are part of the Mountain House property and are a fine feature of the surroundings of that resort. In the town of Athens, Greene county, are Hollister lake, Green's lake, Black lake and Canoe lake, and in the town of Coxsackie is Bronk lake. This is rather a poor showing for an entire county, but the conformation of the land does not allow of the accumulation of bodies of water. Ulster county makes a little better showing. Eight towns have lakes or ponds in them. The town of Hardenburgh has four lakes in it, Beecher pond, Balsam lake, Furlow lake and Tunis lake. These are all owned by private parties and held by them for their own enjoyment. Denning has two ponds, known as East pond and Round pond. Woodstock has Copperas lake, near

the Overlook House, and Shues lake. Rosendale has the Binnewaters, of which there are five, in two groups. The first group embraces the first, second and third Binnewaters, and the second group the fourth and fifth Binnewaters. *The water from these lakes goes to the Rondout creek. Hurley has one, Temple pond. Marbletown has one, without a name. Rochester has Lake Mahonk, a noted summer resort. Wawarsing has three, Cape pond, Long pond and Little Mud pond. Long pond is a good-sized body of water, covering fifty or more acres and is deep, with precipitous sides.

Sullivan county is full of lakes, the lay of the land being such as to permit the formation of hollows, in which bodies of water have accumulated. Consequently there are found from one to fifteen lakes in every town of the county, but none of them very large. They are distributed in groups, chains and singly, adding a degree of picturesqueness not found in other parts of the Catskill region. Delaware county partakes more of the nature of Greene and Ulster counties, the contour broken and the valleys steep and abrupt, consequently there are few lakes and ponds. Such as there are lie near the Sullivan county line and along the Delaware river. These lakes, mostly fed by springs or streams of spring-water, are eagerly sought by sportsmen, who stock the waters with choice fish. Many of them contain trout and others pickerel, for the preservation of which boards of supervisors have passed laws, but from the fact that there is lacking a strong hand to enforce them they remain inoperative. Many streams and parts of streams in Ulster county are leased from the owners and used as private fishing ground by the parties leasing them.

The forests of the Catskills originally were made up of the same mixture of hard and soft timber as is at present found in undisturbed sections of the Adirondack wilderness: Pine, hemlock, spruce, balsam, maple, birch, beech, ash, oak, hickory, ironwood, and some elm and poplar. The original pine timber was cut out so many years ago that the memory of the generation of our fathers cannot recall when it was done. No doubt the earliest settlers, away back in the first years of the last century, are responsible for the disappearance of this kind of timber.

In many places there exist at the present day groves of second-growth that have sprung up from seed, but the timber is in

most cases of an inferior quality and does not make good lumber. It finds a little use in the shape of dock-logs, square sticks of timber used to protect the outer edges of docks and wharves. Many logs when cut will present a fair appearance, with a smooth trunk and clear ends, but when sawed up into lumber the old knots which have been grown over by the successive annual rings, show themselves, and, as one lumber merchant expressed it, "there are fourteen of 'em to the square foot." Such timber has no market value and it does not pay to grow it. There is some spruce still to be found in the Catskills. A considerable quantity of it is sawed along the headwaters of the Schoharie creek in Greene county; the sawed timber is used in the vicinity of the mills for building purposes and for the manufacture of packing cases, in which articles manufactured from other kinds of timber are shipped to market. There is also a limited supply of hemlock, the greater part of which is in Sullivan county, although there is a small quantity in the towns of Denning and Hardenburgh, Ulster county, which, however, adjoin Sullivan county on the north. The largest part of the supply of tanbark is shipped from the towns of Sullivan county, and it is on this limited supply that the few tanneries now doing business are dependent. Thirty years ago this Catskill region was in places a dense hemlock wilderness and the business of tanning was the leading industry, at least in Sullivan county and other parts of the Catskill counties, but the avarice of the tanners got ahead of their judgment, and the timber was slaughtered for the bark alone. Many small watermills drove a precarious living on the leavings of the bark-peelers, but the peeling progressed much faster than the sawing, till the woods became filled with the dry trunks and drier tops; then the fire caught in these old "peelings," and the old story of total denudation was repeated, perhaps for the first time here, but has been followed up by a repetition every year, with more or less disastrous results. Many localities show these fire-scars; some are recovering, slowly, to be sure, but still a young and hardy timber growth is there, which in time will grow into a tall forest. Some places have never recovered from the effects of the fire and never will, for the soil that sustains the life of the tree has been consumed or washed away. A steep mountain-side once deprived of the mass of clinging roots, moss and leaf-mold, with a network of branches above or a canopy of leaves to break the force of

driving rain-storms, is shorn of its power to withstand this force of nature, and the loose masses of loam, sand or other earth overlaying in many instances only to a shallow depth, the smooth faces of the rock, become detached through the action of frost, are washed into the streams threading the valleys below and are carried away to enrich some other section. A thousand years will not re-clothe these denuded mountain-sides with forests, and they are useful for no other purpose. The forests of the Catskills as they now exist are mainly of hardwood, and, lacking the appearance of density which a copious sprinkling of evergreens give, they appear thin to the traveler passing through or by them in the winter time, which illusion is somewhat dispelled when the trees are in full leaf.

There are still some noble forests crowning the ridges among the headwaters of the Schoharie creek in Greene county, and of the Beaver kill in Ulster county. Mr. S. H. Hine of Cairo, writing in regard to the timber in the mountain regions of Greene county, says :

"The hard timber of our mountains consists of hard maple (curled and birds-eye), rock and white oak, with some red and yellow oak, hickory, white ash, iron wood, beech, and black and yellow birch. The largest one variety of hardwood is hard maple, and where it has been left in the virgin state it gives fine specimens. Curled and birds-eye maple have been more eagerly sought for on account of their value for veneering. The soft woods consist of spruce, yellow and white pine, basswood and hemlock, with a large percentage of spruce, which is used for building purposes and in its virgin state shows fine specimens. The reckless waste of mountain forests is plainly visible in this section."

The same remark is applicable to the whole Catskill region, no matter from which side it is viewed, and this is not a thing of the past, nor is the remark to be construed as in the past tense; the "reckless waste" is going on all the time, and the noble forests mowed down to satisfy the cupidity of man, with no thought of replacing them and no provision for their regrowth; in fact the very shoots struggling up at the base of the parent stem possess a marketable value, and scarcely number three years of existence before they are shorn at the root, but so profuse and lavish is nature that another three years sees others as strong and rugged in their place. Some balsam and red cedar are found in the Catskills; there is a stunted growth of the former between Haines's Falls and

Tannersville in Greene county. The red-cedar is found nearer the Hudson river on the mountain slopes facing the valley; it possesses little economic value, as the trunks are stunted and curled, and when sawed up the lumber is full of knots. There is a slight consumption of this timber in fence posts, but the supply is nowhere abundant, and hence it is of little importance. In Sullivan county and the southwestern part of Ulster county bordering on Sullivan, considerable "American laurel" (*Kalmia*) grows in the woods. It possesses no economic value, however, but is evergreen and hardy and will maintain a foothold where other shrubs would perish. Its presence saves many a mountain side from the appearance of total denudation.

In some of the cloves there can be seen the straight, smooth trunks of the basswood, maintaining foothold among the loose masses of rock and in the shallow soil, their inaccessibility having proved their salvation, as there exists an active demand for this timber for the manufacture of excelsior. There is a large consumption all around the whole circumference of this region of nearly all varieties of wood, both hard and soft, and there is no part, except the more remote and inaccessible, but that is called upon to contribute to support, wholly or in part, some industry which means destruction to the forests. With this cutting away of timber there seems to be no provision made for a continuance of the supply, which implies the abandonment at no distant day, of important industries, and the loss to this section of capital and the proceeds of capital. It would be well for the men who conduct these industries to think ahead a little and observe if they can not see the end in the near future, and provide against it in the way that hard experience has taught the people of older nations.

The average quality of the soil of this region is many grades higher than that of the Adirondacks, and those sections which have been cleared up and placed under intelligent cultivation have yielded a fair return. The soil is loamy in the greater number of localities, though there are places where the stones are too thick for the soil to accumulate. Clearings in such places hardly afford poor pasturage and there is no excuse for making them. In referring to this region, the mountainous portions only are meant as the farms along the Hudson river are rich soil and highly cultivated, the peach and grape crops alone grown on them yearly amount in value to hundreds of thousands of dollars. It would be a false economy to

advise the reclothing with forests of regions so especially adapted to cultivation as are these river farms. Agriculture in the mountainous parts occupies, however, a secondary place as a means of gaining a livelihood. The business of entertaining summer boarders from small beginnings has increased to such proportion that the majority of the farmers give up their agriculture and even their homes to care for the seekers after health and recreation.*

The State of New York owns lands in each of the four counties embracing the Catskill region, of the following amounts, viz: Greene county, 661 $\frac{1}{2}$ acres; Ulster county, 32,818 $\frac{1}{2}$ acres; Sullivan county, 576 $\frac{1}{10}$ acres; and in Delaware county, 12,262 acres, a total of 46,318 $\frac{1}{10}$ acres. The State lands in three of these counties, viz.: Greene, Ulster and Sullivan, constitute and are known as the Catskill Forest Preserve, and are subject to the provisions of the law creating the Forest Commission. Delaware county was excepted, and the State lands within that county are still under the control and management of the Commissioners of the Land Office and the State Comptroller. While this state of affairs exists the people of this county lose the benefit of the act of May 5, 1886 (chapter 280, Laws 1886), which provides for the taxation of State forest lands in the counties embracing the forest preserve. This tax on 12,262 acres would amount to a considerable item and would practically affect those towns where the taxes are felt most burdensome. Also the Forest Commission, through its officers, would throw a protection around those sections particularly exposed to ravages by fire, which could not fail to be productive of good and lasting benefit to the owners of wild and forest lands in this county.

The State's title to the lands in this preserve has come through tax sales by the Comptroller, resale of bonded lands, and bidding in loan mortgage lands. By far the greater amount has been acquired by the State bidding in the parcels at tax sales. In Greene county the titles, with but one exception, were acquired through the Comptroller's tax sales of 1877 and 1881. In Sullivan county, those in the Hardenburgh patent were acquired through the 1871 tax sale, while the remainder of the lands in the Minisink patent were

* The New York, Ontario and Western Railroad Company estimates that the summer visitors to Sullivan, Ulster and Delaware counties in 1886 expended there a sum equal to four fifths of the total annual value of the farm products of those counties.

derived severally from mortgage sale, tax sale of 1826 and of 1871, 1877 and 1881.

The title to the State's land in Ulster county has been derived through the county treasurer's tax sales of 1879, 1880, 1881, 1882 and 1883, and the State Comptroller's tax sales of 1871, 1877 and 1881, with a few parcels bid in on mortgage sale. Chapter 260, Laws of 1881, authorizes the sale of lands by the county treasurer for arrears of taxes and legalizes previous sales for taxes made by him. Under this law the county became possessed of a vast amount of wild land, for which there was no market, and from which it derived no benefit, as the lands were untaxed and unproductive of revenue, the county, therefore, found them a dead load on its hands.

Through the enterprise of one or two citizens of Kingston an act was passed repealing the several laws, as far as they affected the county of Ulster, concerning the bidding in of lands by its treasurer, at sales for arrears of taxes, and also authorizing the county treasurer to transfer to the Comptroller all certificates in his possession transferred or issued to the county of Ulster; also legalizing all sales for non-payment of taxes, heretofore made by the Comptroller, whether for the county of Ulster or for the State; also to confirm and make valid the title to said lands, notwithstanding any defects in the assessment thereof, or levying of taxes thereon, unless the title be questioned in a legal proceeding commenced within one year from the passage of the act. This act was passed April 20, 1885, just twenty-five days before the passage of the act creating the Forest Commission. Here, again, is an evidence of forethought and prudence, which from the earliest history of this region has always been justly attributed to the inhabitants of Wildwyk, now the city of Kingston.

The following table shows the distribution of the State lands among the different towns of the three counties, as well as the percentage that the area of State lands bears to the whole area of wild or forest land in the towns.

GREENE COUNTY.

Total Number of Acres, 379,860.

	Area of State land.	Area of town.	Area of wild or forest land.	Per cent of State lands.
Town of Cairo.....	151 acres.....	35,808 acres...	28,646.4	.53
Town of Lexington...	507½ acres.....	47,511 acres ...	38,009.0	1.33
Total in county...	661½ acres	83,319 acres ...	66,655.4	.....

SULLIVAN COUNTY.

Total Number of Acres, 604,705.

Town of Highland ...	91½ acres	33,050 acres ..	19,830	.46
Town of Neversink...	293½ acres	45,480 acres ..	22,740	1.29
Town of Lumberland.	191½ acres	32,325 acres ..	25,860	.73
Total in county...	576½ acres	110,855 acres ..	68,430	.....

ULSTER COUNTY.

Total Number of Acres, 663,331 acres.

Town of Deming	19,227 ½ acres..	63,668 acres ..	50,984.4	37.75
Town of Esopus	20 acres..	22,247 acres ..	2,224.7	.90
Town of Gardiner ...	11½ acres..	25,558 acres ..	2,555.8	.45
Town of Hardenburgh	10,208 acres..	53,646 acres ..	42,916.8	23.78
Town of Hurley	63 ½ acres..	20,721 acres ..	2,072.1	3.06
Town of Kingston ...	60 acres..	4,504 acres ..	450.4	13.32
Town of Marbletown.	27 acres..	31,696 acres..	3,169.6	.85
Town of Olive	1,747 acres..	37,168 acres..	7,433.6	23.50
Town of Plattekill...	37 acres..	20,890 acres..	6,267.0	.59
Town of Shandaken..	1,115 acres..	67,811 acres..	33,905.5	3.28
Town of Shawangunk	½ acre..	35,039 acres ..	21,023.4	.02
Town of Ulster	10 acres..	15,077 acres ..	1,507.7	.66
Town of Woodstock..	131 acres..	37,085 acres ..	14,834.0	.88
Town of Wawarsing..	160 acres..	73,470 acres ..	29,888.0	.54
Total in county...	32,818 ½ acres..	508,600 acres ..	218,683.0	.....

On the above number of acres of State land in Ulster county, the State paid a tax of \$638.25 for the year 1886.*

By glancing at a township map of these counties it will be readily seen that the majority of the parcels in these three counties are situated in widely separated towns, with the exception alone of Hardenburgh and Denning in Ulster county, where a very large

* No returns were made by the assessors in Greene and Sullivan counties on State lands within their districts.

body of State land is found, the parcels of which lies in bodies and close together. They are the two wildest and most mountainous towns in the county and with the exception of Shandaken and Wawarsing possess the largest area; they also have the lowest proportional rate of valuation and the fewest inhabitants. It is said of Hardenburgh that there is not a liquor saloon or a store in the whole town. In Greene county, the town of Cairo is near the center, while Lexington is near the south-west corner of the county. In Sullivan county, the town of Neversink is in the extreme north-east corner of the county, while Highland and Lumberland border on its southern limit along the Delaware river. This cannot, however, be construed into a disadvantage as it gives a widely extended territory in which the advantages of, and results to be derived from, forest culture, can be better demonstrated to a large number of people.

The means of communication between different sections of this region are very good. Highways for the most part lead from the river, up the valleys of the principal streams and from these other roads find a passage-way across from one valley to another through the numerous "cloves" or notches in the mountain ranges. A network of communication is thus formed, which serves advantageously for getting from place to place in this region. Other roads have been built along the sides and on the crowns of the ridges, where the wildness of the scenery is the only attraction offered to any one who will risk the fatigue of the climb. Aside from the roads, a perfect maze of paths leads from each of the large summer hotels or places of resort to all the points of interest in which this region abounds. The roads are in some places up very steep mountain sides where the wash from spring rains gulleys them out to such an extent that they are made impassable at times. The soil, however, is very advantageous for road building, and the abundance of flat stones of a large size enables the highway commissioners to thoroughly drain their road beds, which is one of the main requirements in the construction and maintenance of a good road. This same stone also breaks up readily and mixing with good binding earth or clay forms a road bed which in summer becomes as hard as a floor and gives off very little dust. Material of this nature also has great resisting power to the erosive action of water, else these steep mountain roads would be impassable two-thirds of the year.

The discovery of the vast deposits of coal in the Lackawanna beds and the difficulty of floating it down the Delaware river in "arks" to market it, or of carting it or of sledding it over the mountains in small quantities and at great expense, left the owners of these rich mines in such a shape as not to be able to compete with those companies who were flooding a newly created market with coal from other and more accessible regions. This led to the study of the region which formed the natural outlet from the Lackawaxen. The Delaware river had been tried and abandoned as more coal was sunk beneath its waters than was got to market. An examination of the valleys disclosed the fact that a canal could be built from Lackawaxen on the Delaware at the southern end of the town of Highland to Port Jervis at the junction of the Neversink river; thence up the valley of this river to its point of deflection toward the north-west; thence up the valley of the branch joining the main stream at this point, to the summit of the water-shed of the Rondout creek near Wurtsborough, and thence down the Rondout valley to tide water in the Hudson at Rondout. "The scheme of the Delaware and Hudson canal was one of William and Maurice Wurts, of Philadelphia; the survey was made by Benjamin Wright, in 1824, and the estimate cost was \$1,300,000; actually constructed it cost considerably more. The canal and railroad were commenced in 1826 and completed in 1828. At first the canal was intended for boats of thirty tons burden; subsequently its capacity was so enlarged as to admit vessels of fifty tons, and finally, improved so as to pass boats of 130 tons." The canal passes through the cement regions about Rosendale, and supplies the means for bringing the coal for burning, and for carrying away the manufactured product. The New York and Erie Railroad, now the New York, Lake Erie and Western, was chartered in 1832. The Legislature appropriated \$15,000 to enable Benjamin Wright and his subordinates to examine the route and report the result. His report may be found in the Assembly Documents of 1835. On the route as reported, the road was not built except that portion of it through the valley of the Delaware river. The railroad enters Sullivan county at Ten Mile river and follows along the banks of the Delaware, passing out at the intersection of the division line between Sullivan and Delaware counties with the river, and thence continues along the river to Deposit, where it passes out of Delaware into Broome county.

The New York and Oswego Midland, now the New York, Ontario and Western, was completed on its present location in 1873. It strikes into Sullivan county near the south-east corner of the extreme eastern part and passes diagonally across the county through the towns of Mamakating, Fallsburgh, Liberty and Rockland, passing into Delaware county at the junction of the Willememoc with the Beaver kill, thence across the southern end of Delaware county it passes into Chenango county at Sidney.

The New York, West Shore and Buffalo Railroad enters Ulster county at the south-east corner of the town of Marlborough and follows the river through those towns adjacent to it, through Ulster and Greene counties, connecting with the Wallkill valley and the Ulster and Delaware railroads at Kingston, and with the Catskill Mountain Railroad at Catskill. The West Shore and Midland unite at Cornwall in Orange county. The Wallkill Valley Railroad connects Kingston in Ulster county on the line of the West Shore Railroad with Campbell Hall in Orange county on the line of the New York, Ontario and Western Railroad. It passes through the cement burning region. The Ulster and Delaware Railroad starts at Kingston at the junction of the West Shore with the Wallkill Valley Railroad, and follows the course of the Esopus creek across the northern towns of the county. and thence into Delaware county near the north-east corner of the town of Middletown, thence across this town and the town of Roxbury, and finds a terminus at Hobart, near the center of the town of Stamford. It is a road of heavy grades and sharp curves, but serves as an avenue of approach to those wishing to reach the heart of the Catskills.

From Phoenicia, a station on the Ulster and Delaware Railroad, situated near the north-east corner of the town of Shandaken in Ulster county, a narrow gauge road has been built through the Stony clove across to the valley of the Schoharie creek giving access to the numerous summer resorts at Hunter, Tannersville and landing guests at the Laurel House, Hotel Kaaterskill and the Catskill Mountain House, at an elevation of over 2,200 feet above the Hudson river. This road is operated only from Phoenicia to Hunter during the winter, there being two or three wood working concerns of considerable importance along this portion of the route. The portion not operated through the winter is called the Kaaterskill Railroad.

The Catskill Mountain Railroad connects Catskill village on the line of the West Shore Railroad with Palenville, lying at the foot of the mountain, on the top of which is the Catskill Mountain House. It is a narrow guage road. There is also a branch to the village of Cairo. The main road was opened in 1882 and the branch in 1885. The main road is entirely within the town of Catskill in Greene county; the branch starts from near the north-west bounds of Catskill, thence to near the center of the town of Cairo.

The Albany and Susquehanna branch of the Delaware and Hudson Canal Company Railroad, follows along the valley of the Susquehanna from its headwaters, skirting the western bounds of Delaware county. In Delaware county there is a branch railroad from Walton, a station on the New York, Ontario and Western Railroad to Delhi; in Sullivan county a branch from Summitville in said county to Ellenville in Ulster county, and another branch from Port Jervis in Orange county, on the line of the New York Lake Erie and Western Railroad to Monticello, the county seat.

The following table, compiled from the "Report of the Railroad Commission," will give a fair idea of the magnitude of the railroad interest in the counties embracing the Catskill forest preserve.

County.	NAME OF RAILROAD.	From —	To —	Gauge.	Miles.
Delaware.	New York, Ontario and Western. . .	East line of Co	Sidney.	Ft. in. 4 8½	62
Delaware.	Delhi branch.	Walton.	Delhi.	4 8½	17
Delaware.	New York, Lake Erie and Western.	East line of Co.	Deposit.	4 8½	11
Sullivan..	New York, Ontario and Western. . .	East line of Co.	West line of Co.	4 8½	56
Sullivan..	Ellenville branch. .	Summitville. . .	Ellenville. . . .	4 8½	8
Sullivan..	New York, Lake Erie and Western.	Ten Mile River.	West line of Co.	4 8½	22
Sullivan..	Port Jervis and Monticello.	South line of Co.	Monticello. . .	4 8½	12
Ulster....	New York, West Shore and Buffalo	South line of Co.	North line of Co	4 8½	18
Ulster....	Wallkill Valley. . .	Kingston.	South line of Co.	4 8½	13
Ulster....	Ulster and Delaware	Kingston.	Hobart.	4 8½	27
Ulster....	Stony Clove and Catskill Mountain.	Phoenicia.	Hunter.	3 0	6
Greene....	Kaaterskill.	Kaaterskill Jun.	Catskill M. house	3 0	3
Greene...	New York, West Shore and Buffalo	South line of Co.	North line of Co	4 8½	15
Greene....	Catskill Mountain. .	Catskill.	Palenville. . . .	3 0	16
Greene....	Cairo branch.	Junction.	Cairo.	3 0	4
Total miles.					290

The above table shows a large mileage in these four counties. The majority of the railroads run directly through heavily timbered sections, and into these sections particularly are the greatest number of trains run, and in consequence there must be a greater exposure of the woods and waste places to the liability to catch and carry fire from the numerous engines passing over the road. The summer traffic comes in the four driest months of the year, June, July, August and September, when the woods are in the driest condition, and it is at this season that disastrous fires have occurred in the past. During July and August these pleasure roads in the mountains run from five to eight trains a day each way. This becomes necessary when the vast number of people who visit this region every year is taken into consideration. The New York, Ontario and Western railroad distributes about 25,000 people from their railroad through Sullivan Ulster and Delaware counties. The Catskill Mountain Railroad distributes among the mountain resorts of Greene county about 35,000 people. The Ulster and Delaware Railroad carries into the same section and among the resorts of Ulster and Delaware counties about 35,000 more. Stages and private conveyances carry perhaps 5,000 more, and the New York, Lake Erie and Western leaves 20,000 people to admire the beauties of the Delaware. The total of 120,000 people does not over-estimate the amount of travel to this Catskill region. It is but a hundred miles from New York, Brooklyn and Jersey City, teeming with their millions of population.

This region has not entirely been given over to the interests of the pleasure seeker, though it forms the natural picnic ground of the vast populations of New York and vicinity. For that reason alone, inasmuch as it brings health and vigor to replace wasted vitality to the thousands who seek the pure air of its mountains and the sparkling water of its living springs, part of this region at least should be left in as near a state of nature as at this late day is possible. It is many years ago (nearly half a century) since the Old Mountain House was sought out by the aristocracy of New York and Baltimore, long before railroads were thought of and when the stage coach was the only means of conveyance. Here the great merchants of the one and the wealthy planters of the other discussed the political issues of the day on its broad veranda and gathered new life and strength from the invigorating atmosphere, while

the wife of the merchant sought to arouse vexation and jealousy in the heart of the wife of the planter by the display of finer tissues of silk and laces and a more liberal supply of jewels. Much the same scenes are still enacted on the same old spot; but there came at times uneasy minds and roving spirits, who explored for the sake of finding something new. Gradually the beauties of this whole region became known, and were written about, till finally every valley, many of the mountains and the desirable places generally became more or less known and finally occupied by a people who make it their business to care for the multitudes who annually swarm to this region for three or four months and leave it desolate for nine.

The fine fishing afforded by the many mountain streams attracts another class of people who come to this region as early as the first of May, but whose stay is very brief. Its proximity to New York makes it an easy matter for the city sportsman to leave business for a few days to angle for the trout in the clear waters of the streams. So common became this practice that the natural increase of the fish could not keep pace with the rate they were taken out, so that artificial stocking of the streams had to be resorted to. Various parties, private individuals and railroad companies have brought thousands of young trout from the artificial hatching establishments through the State and have turned the young fry loose among the headwaters of the streams and into some of the lakes and ponds, so that in localities where somewhat protected they now enjoy fine sport, but in the streams where the public is allowed to fish even this liberal supply has proved anything but permanent. Hunting in this region is confined chiefly to grouse, rabbits, squirrels and such small game. Deer are rarely seen and much more rarely killed. The last of the deer were killed off some twelve years ago, when there was a great body of snow fell, on which a crust formed of sufficient strength to bear the weight of a man. Pot-hunters came into this region, presumably from Pennsylvania, and killed large numbers of deer, from which the hides were taken and the carcasses left to rot in the woods. Since that time the hunters have been able to keep pace with the natural increase of the few that were left from the wholesale slaughter. It is fair to suppose that there are not a dozen deer in this whole Catskill region, though the natural features are such as to provide all the requirements for an abundant increase if they were protected and left unmolested to

roam the woods at their own sweet will for a few years. In early times the Dutch settlers hunted wild turkeys along the beech ridges in the town of Callicoon in Sullivan county; indeed it is said that the name of the town is derived from the sound used by the early hunters in imitation of that bird's note of calling. Be that as it may, there have probably been no wild turkeys in this region or any other part of it for nearly a hundred years, and it is doubtful whether the conditions are such that they could ever be induced to thrive again in the thin, open woods that occupy the places of the then dense forests of that region along the Delaware. There are many miles of streams, the waters of which are leased from the owners by parties residing elsewhere. These waters are kept stocked and to the owners afford fine sport. The same is true of many ponds on whose banks can be seen the club-houses of the owners, who annually repair to the same to enjoy the benefits of out-door life. The cause of the decline in the supply of game and fish in this region is therefore manifest. The cupidity of a few men has caused the deer to become nearly extinct in this region, and the leasing of streams has diminished the amount of public waters; consequently those that are left free and open are "fished to death" the first week at the opening of the season and kept in that condition by the army of hungry sportsmen who come later.

It is a matter of great difficulty to tell when the first tanning business was started in this region. The construction of the Delaware and Hudson Canal opened up communication through Sullivan county. This was in 1828, and in 1831 the historian says John Eldridge, Rufus Palen and one or two other large tanners commenced operations here and were followed by other men of their calling, as the bark of Greene, Schoharie and Ulster counties was exhausted. Then Sullivan county became the most important sole-leather manufacturing district in the world. From this it would appear that Greene and Ulster counties were the scenes of the earliest tanning operations.

At Prattsville, on the Schoharie creek, are rocks on which are carvings commemorating the doings of Hon. Zadoc Pratt in this region in years gone by. One is to the effect that 1,000,000 sides of leather were tanned in twenty years with the bark of hemlock cut on the neighboring mountains. Through the Kaaterskill Clove are

to be seen the ruins of old tanneries and the houses of the workmen. Inside the foundation walls of one old tannery are now growing birch trees eight and twelve inches in diameter. The banks of the Schoharie creek from Hunter to Lexington show frequent remains of old tanneries. Manufacturers found it easier to cart the raw materials to the bark than to cart the bark to the hides, hence the progress has been from Greene to Ulster and thence to Sullivan, from which latter a limited supply of bark is yet to be had. Five years more will witness the last of the tanning with hemlock bark got from this region. So much bark being stripped left a plethora of timber lying in the woods. Some few small saw mills, run by water, were located along the streams, up whose valleys the bark peelers had gone. The owners sought to make a few dollars by sawing up into lumber the immense trunks lying around in profusion, but their mills were of small capacity, and it is safe to say that they did not saw ten feet for every thousand feet that lay in the woods. Old residents say there were never seen such hemlock forests as clothed these mountains, majestic, dark and grand, but that after the bark peelers passed through, millions of feet of the best hemlock timber lay rotting in the woods, and millions more of feet were consumed by the terrific fires which swept through in the way prepared for them. Many claim that if the tanners had never come into this country, these counties would be credited among the richest in the State, instead of being poor and insignificant as they now are. Be that as it may, the hemlock timber is gone, the spruce is practically exhausted, and the determined attack being made on the hard wood will soon witness its extermination also. What then will remain? There are other industries which find a ready use for the young shoots. The prospect, therefore, seems to be that this region is doomed to total and continued denudation, with the exception of the few acres owned by the State, and a few by private individuals, which, under their present management, will be retained as forest land, but under the care of new hands may be devoted to destruction.

Lumbering, except in those sections adjoining the Delaware river, has never seemed to be the industry that it is in the Adirondack region. The rough mountain streams were perhaps not suitable for driving logs. At any rate it does not seem to have been the practice here. The low lands along the Hudson were, at an early day,

cleared up for cultivation by the Dutch settlers, at Esopus and Hurley, and by the Huguenots of New Paltz, and history does not give any account of lumbering operations in these localities at any early date. Sullivan and Delaware counties, however, were the scene of quite extensive lumber operations, as, for instance, they have been carried on in the town of Rockland since 1798. Rockland lies in the north-west corner of the county, and is many miles from the Delaware river, but it has within its limits the Willewemoc and Beaver kill, which are tributaries of the east branch of the Delaware. At a much earlier date than that given above, rafting was attempted on the Delaware river with a great or less degree of success. Great rafts of timber bound and locked together would be started down the broad current, poled over the sluggish places and guided over the rifts, sometimes successfully, at other times to go to pieces in a hopeless wreck on some jutting rock when the luckless raftsmen counted himself fortunate to escape with his life.

They had their laws, too, these early lumbermen. "In 1791 every non-resident of the town of Mamakating, Sullivan county, rendered himself liable to a fine of 'six pence for every inch across the stump' if caught trespassing by cutting on the timbered lands of another. No exception was made in favor of those who owned real estate in Mamakating but resided elsewhere." Here is an evidence that goes to verify the assertion that a tree in the woods, if of a choice variety as a cherry, curled maple or ash, is considered to be the property of him who discovers it. Timber thieving seems to be a practice sanctioned by the customs of our forefathers, but at the same time was viewed with disapproval by the law-abiding, and also by the owners of desirable standing timber.

Fires have caused much damage through this section, no doubt the railroads are responsible for some of them. But they owe their origin to various causes, which here are very similar to those which give rise to fires in the Adirondack preserve. Berry pickers are here credited with starting many of the fires. The proximity of the New York market and the great demand for the really fine quality of the whortle-berries, which abound on the mountain sides, where for some reason or other the timber has been removed, has caused this class of people to adopt the custom of burning over the fields, with a view of increasing the yield. This is done every year or so, and results in keeping down the young growth of timber

which would otherwise spring up in the sufficient soil with which the majority of the mountain sides are covered. The Ellenville Water Works Company suffers from this cause, and a vigorous effort is being made to protect the part of the Shawangunk mountains occupied by the watershed from which they gather their water supply. It is said that the whortle-berry crop on these mountains, in the neighborhood of Ellenville, is worth from four to five thousand dollars annually, and also that there are houses and lots in the village whose owners have paid for them with money earned by picking berries on the Shawangunk mountains. This is very nice for them, as it amounts almost to a free gift from nature, but it is obtained at the expense of denuding several thousand acres and hindering the timber growth which in time would reclothe this barren ridge with a forest. As has been hinted at, there are many industries located in and about the Catskill mountain region which are annually making great inroads on the hard wood with which the mountains are thinly covered. Where found the soft varieties suffer also, as there is a ready use found for all. In the first place there is considerable building going on all the time, in the valleys, on the mountains, and everywhere that it is thought an attraction exists to draw the much-prized summer boarder. Farmers who have brought up their families in the little low house with one gable tear it down and build in its place a house of many gables. Building, however, is the least harmful of any of the industries. A demand exists in nearly all localities for hemlock and spruce for these operations, and is almost wholly supplied by local saw-mills; the pine and finishing lumber comes from outside. There is an active demand for bird's-eye maple and for cherry; the former is used in making veneering. Such is the demand for this that the remotest regions are searched, and wherever a tree is found it is taken, regardless of the ownership; the same is true of the cherry. In some sections choice rock maple is sawed into what are called piano-bars. They are made from the best and straightest grained maple, and are two and a-half inches by four inches by six feet. The same mills that cut piano-bars also cut what is known as chair-stock. This is sawed from almost any kind of hard wood, it not being necessary that the grain should always be straight. Dimensions of stock, two inches by two and a half inches by eighteen inches. In other sections clear straight maple is made into roller-

blocks, used in paper mills and calico-print works. These are manufactured and shipped only during the three winter months; the stock is turned up roughly to full six and a quarter inches diameter and twenty-six inches in length. Each roll has to be perfect, with no checks or bad spots. Thirty to forty car loads of these roller-blocks are shipped yearly from Livingston Manor, in Sullivan county. The same firm which ships the roller-blocks manufacture base-ball clubs, Indian clubs and dumb-bells; the two latter are made largely from the cull roller-blocks. The stock for ball-bats is two and five-eighths inches square by thirty-five inches to thirty-eight inches long for men's bats, and thirty inches to thirty-two inches for boys' bats. The firm manufactures from twelve to fifteen hundred gross of bats a year, and makes 10,000 pairs of Indian clubs and 25,000 pairs of dumb-bells. Other concerns are engaged in the same line of business. The timber used consists of beech, birch, maple, ash, cherry and hemlock, the latter used for boxing the manufactured goods. There are several chair factories in the Catskill region, the principal location for the business being in the north part of Ulster county and southern part of Greene. The largest factory of this character is in Stony Grove, at Chichester-ville. Here it is said the work is conducted on such a large scale that the green log, fresh from the chopping, is turned in at one end and comes out at the other as one or more finished chairs. Certain it is the log is wholly and completely utilized in one way or another. This concern last year sold 18,000 dozens of chairs, besides thousands of cradles and settees. This factory uses 2,000,000 feet of logs and lumber a year, which comes from the mountains in the immediate vicinity. There are other chair factories at Shandaken, in Ulster county, and at Edgewood and Hunter, in Greene county. Much of the unfinished work is sent to New York.

The wood acid factories, of which there are two in the vicinity of Livingston Manor, consume cord-wood at the rate of fifteen to thirty cords of wood a day. Beech timber is considered the best as containing more acid; birch, maple, oak and chestnut are also used. Lime is used in clarifying the acid. The products are wood-alcohol, acetate of lime, charcoal, creosote and wood-ashes, all of which have a marketable value. It is said the charcoal alone pays for the raw material and labor. A gas is also generated in the

retorts which is utilized in lighting the works which run both night and day.

There are also scoop and bowl makers scattered through the northern section of the town of Rockland, Sullivan county, and the southern part of Hardenburgh, Ulster county. Meat trays are also manufactured. These articles are made from the choice part of the trees, and by a class of poor farmers living in the mountain wooded districts. They find a ready sale, for all they make, at the grocery stores.

Some few oak piles and a little oak ship-timber is cut near Catskill. Other uses to which wood is put in this region, is the manufacture of excelsior from basswood; the manufacture of barrel-hoops from young hard wood saplings; of headings from all kinds of hard and soft wood; of railroad ties (of which there is a large number used annually by the railroad companies whose lines penetrate and cross the region), and last, but by far the greatest use, is in supplying the demand for cord-wood, at the immense brick burning establishments scattered along the Hudson river from Catskill to Croton, the principal of which, however, are at Haverstraw. A few concerns have tried the use of coal, and with good success, but the majority of them prefer to use wood. An immense traffic in this cord-wood has sprung up, brought about by the demand for brick, created by the building of such structures as the Croton Aqueduct, and the unusual activity in the construction of buildings in New York city. Farmers near the river towns finding a ready market for their wood, have cut off many acres of steep hillside adjacent to the river, where the land lies at such a declivity that the cultivation of it is at once out of the question. In this way many beautiful patches of wood which, with other features combined to give to the scenery of the Hudson river its just celebrity, have been laid under contribution, and become denuded slopes, on which it will be many years before a tree growth will again flourish. This wood comes also from along the lines of the various railroads, particularly the New York, Ontario & Western Railroad from Sullivan county.

Some chestnut fence posts are cut in the vicinity of Ellenville and shipped from that place. Also what are called river posts, eight, ten and twelve feet long, used in New York city in cellars, etc.

There has been enumerated the different industries which consume the forest growth of the Catskill region. As regards the

distribution of them they are found, in general all around and through this whole section. But particular industries seem to have a somewhat particular locality in which they best flourish.

Turning, including roller-blocks, bats, Indian clubs, dumb-bells, bowls, trays and scoops, as well as the manufacture of wood acid, is located chiefly in the town of Rockland, Sullivan county, Colchester, Delaware county and Hardenbergh, Ulster county. The manufacture of hoops and headings is in its most flourishing condition in the town of Wawarsing, Ulster county. The great bulk of the hoop-poles comes from the Shawangunk mountains. Ellenville is the market for hoops. They are cut, however, more or less all along the line of the New York, Ogdensburg and Watertown Railroad. The chair factories are in the town of Shandaken, in Ulster, and Hunter, in Greene county, which towns adjoin, and the two manufacturing districts are connected by a railroad. The ties are produced in the vicinity of the railroads. Particularly is this true of the Ulster and Delaware Railroad, which I am informed will use this year about 24,200, but whether in an extension or repairs was not stated. Excelsior is manufactured at Wawarsing and Boiceville in Ulster. Chair stock is cut in those sections where it can be got by short haul to the railroads, and is sold to local manufacturers or shipped to New York city. The piano-bars all go to New York city. Sections of birch trees of large diameter are shipped from Livingston Manor to New York to supply a demand for butchers' blocks. Veneers are cut at Ellenville, chiefly of birch for chair bottoms. For this purpose considerable round timber is shipped by rail to Ellenville, from points west in Delaware and Sullivan counties.

It is a matter of great difficulty to get at anything like the exact amount of timber cut in this region per annum, but a near approximation will be found in the following table, with an estimate of the number of acres which would have to be denuded in order to meet this demand. The proportion of cordwood, and feet board measure of timber per acre have been obtained by inquiry in various parts of this region. The majority of men seem agreed that twenty-five cords to the acre of four feet wood is the average yield of Catskill mountain lands, though it has been stated that small parcels have been known to yield forty cords to the acre, but so many agreed on the first figure that this has been assumed as the

proper divisor to use. Inquiry also disclosed the fact that the woods are much denser or the timber much larger in some localities than they are in others. For instance in the town of Hardenburgh the figures given were about 4,000 feet board measure, per acre, for hardwood, while in Hunter, in Greene county, on the opposite side of the valley of the Esopus creek 10,000 feet was given, while in the southern part of the town of Wawarsing, Ulster county, 7,500 feet per acre, and in the town of Rockland in the forest district of Sullivan county, the forests were said to yield 25,000 feet to the acre, which figures perhaps is a trifle high, though the hardwood timber is of enormous size.

TIMBER STATISTICS.

County.	Town.	Feet B. M. of timber sawed.	No. of cords of wood cut.	Number of hoops.	Number of rail-road ties.	Feet B. M. of round timber.	No. of acres yearly denuded.
Greene...	Cairo*.....	180,000	.....	.....	.....	.....	18.0
Greene...	Catskill.....	70,000	2,885	.....	.....	400,000	223.4
Greene...	Hunter.....	600,000	.....	.....	.....	.....	60.0
Greene...	Jewett.....	885,000	600	.....	.....	.....	112.5
Greene...	Windham.....	150,000	.....	.....	.....	.....	15.0
Ulster...	Denning*.....	400,000	.....	2,000,000	.....	.....	40.0
Ulster...	Hardenbergh*.....	400,000	.....	.....	.....	.....	40.0
Ulster...	Marlborough.....	125,000	.....	.....	.....	.....	12.5
Ulster...	Olive*.....	200,000	1,600	.....	10,000	.....	104.0
Ulster...	Saugerties.....	.....	4,500	.....	.....	.....	180.0
Ulster...	Shandaken*.....	3,200,000	.....	.....	14,200	.....	348.0
Ulster...	Wawarsing*.....	1,600,000	12,275	43,000,000	200,000	.....	749.4
Ulster...	Rondout and Kingston.....	.....	8,800	.....	.....	.....	352.0
Sullivan...	Bethel.....	750,000	.....	.....	.....	.....	30.0
Sullivan...	Callicoon.....	100,000	.....	.....	.....	.....	4.0
Sullivan...	Cochection.....	200,000	.....	.....	.....	.....	8.0
Sullivan...	Delaware.....	850,000	.....	.....	.....	.....	34.0
Sullivan...	Fallsburgh.....	75,000	14,250	.....	.....	.....	386.2
Sullivan...	Forestburgh.....	6,050,000	.....	.....	.....	.....	242.0
Sullivan...	Fremont.....	300,000	.....	.....	.....	.....	12.0
Sullivan...	Liberty.....	575,000	14,250	.....	.....	.....	379.2
Sullivan...	Mamakating.....	.....	14,250	10,000,000	.....	.....	356.2
Sullivan...	Neversink*.....	550,000	.....	.....	.....	.....	22.0
Sullivan...	Rockland.....	4,620,000	14,250	100,000	.....	50,000	543.0
		21,880,000	87,600	55,100,000	224,200	450,000	2,015.6

* These towns contain lands belonging to the State.

The value of the forest lands of the Catskills varies with the location and with the character of the timber growth. Good hoop-pole lands are worth more than heavily timbered lands; those near manufacturing centers, and along lines of railroad, are more valuable than those that are remote from such. The value of such remotely situated lands depends also on the amount of hemlock or spruce on them. In this connection are given some figures at which wild lands are held in various places in the Catskills.

A tract of 500 acres of woodland in the town of Hunter, Greene county, it is said, could be bought for one dollar and fifty cents per acre, exclusive of the spruce timber which would be reserved. In Stony Clove, town of Hunter, standing timber is valued at fifty cents to two dollars per thousand feet, which would make timber lands about there worth from fifteen dollars to twenty dollars an acre.

Timber lands in the town of Rockland, Sullivan county, are held at four dollars to ten dollars an acre, depending on their location, soil and timber. Two hundred acres in Rockland were sold recently at twelve dollars an acre. The land had a fair cut of hemlock timber on it.

The following information has been gleaned in making a tour of the counties embracing the Catskill forest preserve and will show the opinions of the people on the various matters under discussion.

Two thousand acres in the town of Shandaken, Ulster county, are held at four dollars per acre. Lands in the town of Denning are held at two dollars to ten dollars per acre. Six hundred acres of land from which the hemlock alone had been removed, located in the town of Denning, were recently sold for one dollar and a half an acre. A citizen of Ellenville, who owns 1,500 acres in the town of Wawarsing, will sell at two dollars and a half per acre. Hoop-pole lands near Ellenville, if good, are worth from ten dollars to twenty-five dollars per acre.

Hon. Thomas Cornell owns a controlling interest in the Ulster and Delaware Railroad, running from Kingston in Ulster county to Hobart in Delaware county. The road derives its income from the large amount of freight carried to and from the manufacturing towns in the interior of the county, and also from summer tourists who are attracted by the scenery, mountain air and fishing along the line of the road. The company has spent large sums of money every year stocking the streams with trout fry. Mr. Cornell owns Furlough Lake in the town of Hardenburgh, the waters of which flow into Dry brook and thence to the Delaware. If any stealing of timber takes place in that vicinity, it will be probably on the lots in the Connecticut Tract, in Great Lot 6, of the Hardenburgh Patent, in the town of Hardenburgh, and the timber stolen will be all hard wood, as maple and birch, and would be taken out to the line of the New York, Ogdensburgh and Watertown Railroad and shipped away. It is stated that the railroad would require this year about 24,490

ties, and that they had carried out to the West Shore Railroad 1,350 cords of wood all coming from the interior towns along the line of the road.

THE BRICK INDUSTRY.

An acquaintance with one of the owners of a large brick kiln, brought out some facts in relation to this industry which have a very pertinent bearing on the subject of forest growth. Eight brick yards at Rondout and vicinity use over 8,000 cords of wood. A good portion of it is drawn in by farmers coming from within a distance of fifteen miles of the yards. A large quantity comes from Shandaken on the Ulster and Delaware Railroad. Mountain lands will cut twenty-five to thirty cords to the acre. The ruling prices have been this winter four dollars and fifty cents to five dollars and twenty-five cents per cord. From five to six cords are burned to every 42,000 brick; it takes less wood when the bricks are well dried, and more when business is rushed and the bricks burned wet. There was a brick yard at Kingston as early as 1695, which furnished the first brick used in Kingston.

Another brick-maker at Catskill furnished the following information: Of 500 cords of wood used by him a year, mostly hard wood, at least three-fourths comes from the town of Catskill; the ruling price this year has been four dollars and seventy-five cents per cord. Other concerns about there use over 2,000 cords annually; 300 cords are shipped from there to other places along the river. A yard between Saugerties and Rondout uses more wood than all the brick-yards in Catskill together. Two concerns at Glasco must use 1,000 cords. Another, six miles below, uses 500 cords a year. They own 200 acres of woodland in the the town of Athens and cut therefrom an average yield of twenty-five cords of wood to the acre. Fifty acres are hemlock and pine. The remainder is oak, some chestnut and a large quantity of red-cedar. Brick-makers are beginning to use coal instead of wood, but few yards, however, try it. There are a few thousand feet of oak ship-timber and some oak piles sold here and some pine too knotty for lumber is used for dock-logs. Fifteen million brick are made at Catskill a year. At Cornwall from five to ten car loads of cord-wood are shipped daily to the brick-yards down the river. It all comes from Sullivan county by way of the New York, Ohio and Western Railroad. On the nineteenth of March, there were forty car loads standing on the side track at

Cornwall. The wood is shipped in five car lots. Between Kingston and Cornwall there has been much clearing up of the steep hillsides close to the river; the wood being cut up in to four feet lengths and shipped by the railroad. A resident of the town of Wawarsing, in Ulster county, says 50,000 cords will about represent the amount of cord-wood shipped out of Sullivan county by way of the New York, Ohio and Western Railroad, and the Delaware and Hudson canal; the railroad carrying about two-fifths of the amount. It goes, most of it, to Haverstraw. There is a great quantity of cord-wood piled at many places along the line of the Delaware and Hudson canal ready to be shipped as soon as the canal opens for navigation.

VARIOUS INDUSTRIES.—*Delaware County.*

Griffin's Corners.—One mill run by water power.

Arkville.—Is the shipping point for chair stock cut by mills up the Dry Brook valley in the town of Hardenburgh, Ulster county.

Greene County.

Catskill.—This is the starting point of the Catskill Mountain Railroad, fifteen and three-quarter miles in length; connects Catskill with Palenville at the foot of the mountain. The road is narrow gauge (three feet). It has a branch to Cairo, three and three-quarter miles long, operated for summer traffic only, in June, July, August and September. Through the summer months it carries about 35,000 people. During July and August seven trains each way are run on the main line and eight on the branch. In the spring and fall three trains are run each way. The road was opened in 1882; the branch in 1885. The summer freight business is about one-eighth of the passenger traffic. About one-half the travel goes to Cairo, and one-half to the Mountain House and Palenville. Fifteen hundred acres around the Mountain House are owned by Mr. Beach. The face of the mountain below the hotel has been stripped of its original growth and is now grown up with a thin covering of birch, oak, poplar and white birch. No cutting of timber is done on the hotel lands.

At *Palenville* is a small saw-mill run by water power from the Kaaterskill creek, capacity 1,000 feet a day of boards, or 2,000 feet of lumber; saws both hemlock and oak. Hemlock lumber is worth sixteen dollars a thousand and oak forty dollars. The mill supplies only a local market, the proprietor owns no woodland;

but buys his stock from farmers; he runs a tannery in connection with the mill but has done nothing for the past three years, owing to the low price of leather. There is no bark to be had in the neighborhood.

Haines's Falls.—From Palenville the road follows up through the Kaaterskill Clove, a narrow gorge with high steep mountains on either side. On the north side the mountain is steep, precipitous and rocky, scantily covered with a growth of small trees, as scrubby pines, some cedar and hemlock. To the south the land rises more gradually and has a heavy timber growth, mostly large trees of the hard wood varieties, among which is a fair sprinkling of hemlock and on the tops of the highest ridges is a good growth of fair sized spruce. This valley was cut over by the tanning companies about thirty years ago, and from Palenville to the foot of the mountain are to be seen occasionally the remains of the tanneries and the dwelling-houses of the workmen.

Haines's Corners.—From this place the grade is downward and the water now flows to the Schoharie creek. There is a small saw-mill here of about 2,000 feet daily capacity.

Tannersville, lies partly on the highway and partly on the railroad, the two parts being separated about half a mile. North from the upper portion is a wide stretch of flat country, mostly a farming section, with a few houses. A cluster of large hotels is here for the accommodation of summer boarders. There is a steam mill in the woods working out chair stock.

Clum Hill, across the valley from Tannersville, was burn over some years ago and is now covered with a fine growth of young trees. Many thousand California trout have been put in the streams which here form the headwaters of the Schoharie creek. The board of supervisors have passed a law prohibiting fishing in the stocked streams for two years.

Hunter.—A chair factory here consumes about 125 to 150 thousand feet of lumber a year. One saw-mill cuts about 2,000 feet of lumber a day, mostly spruce. Another, a steam-mill, two miles above towards Stony Clove is the principal mill for building lumber about here; rough lumber is worth about fifteen dollars a thousand. The tops of the mountains here are all more or less covered with spruce, while the sides and valleys are grown up with maple and hard wood a limited quantity of ash and cherry.

The valley was originally covered with pine, above that hemlock and hard wood, and on top of the ridges the spruce. In 1857 fire ran through these parts; poplar sprung up after the burning and is now used for manufacturing excelsior. Seventy to eighty car loads were sent out from here last winter.

An old resident of Hunter says: "Thirty years ago there was a heavy growth of hemlock on these mountains. Twenty-five years ago tanning was the leading industry. Twenty years ago the hemlock became exhausted. Nothing has been done here in that line for fifteen years. There were two large tanneries and two small ones in this vicinity. The working up of the hemlock timber into lumber did not then pay expenses. Very little of the money that was made out of the tanning business staid here. The tanneries left us poor." He sold the poplar on two hundred acres at two dollars an acre for the standing timber; it yielded four cords to the acre. Some of the land about here has become valuable as a source of spruce lumber. Building is active in this vicinity. A tract of five hundred acres below here, known as the McKivver tract could be bought at \$1.50 per acre, exclusive of the spruce timber. The chair factory at Edgewood buys all the logs that can be got from the farmers. The other establishment located below the village does the same. Some logs come from the town of Jewett adjoining Hunter. The price is ten dollars a thousand in the log, and for sawed ash lumber twenty dollars a thousand is paid when delivered at the factory. Six or seven public houses here accommodate from 100 to 150 people each. There are besides a number of families that keep a few boarders during the season.

Lexington.—There is no manufacturing done here; the only business is caring for summer boarders and farming. The Schoharie creek is still-water in front of the village. Thirty years ago there were tanneries in this vicinity, but they were conducted by outside capital, and the money made from the business went away and did the locality no permanent good. Poplar has come up in the old peelings and is now fair sized.

Westkill.—On the branch of the Schoharie, of that name, is a small settlement of houses and summer hotels. Passing south on the highway to Shandaken through the clove the summit is reached about a mile from Westkill village. The mountain sides are very steep, but thickly covered with a good growth of fair sized timber, very little

of which is of any evergreen variety. There is considerable basswood of medium size. Beyond the summit the water runs south, heading in a small pool. No agricultural lands are met until Bushnellville is reached, and here they constitute merely a small strip along the creek bottom, mostly dairy farms. Some timber is cut and drawn to the chair factory at Shandaken.

Bushnellville.—Originally supported a tanning business, a chair factory, and a spring-bed-bottom factory, basswood being used in the latter industry; the factories were run until the timber was all cut out. Business stopped some twenty-five or thirty years ago. The mountain sides for a long distance around are now sparsely covered with a thin growth of small stuff.

Edgewood.—A chair factory on the Stony Clove creek, about four miles above Chichesterville, consumes from 1,000,000 to 1,200,000 feet of lumber a year. There are, perhaps, a million or two feet of standing spruce timber on the ridge between the Schoharie and Esopus creeks. This mill only manufactures "in shape," the material goes to Hunter where it is finished and set up. The price paid here is seven dollars per thousand for timber in the log. The company have about one million feet of logs now in the yard.

Orange County.

Middletown Tannery.—Has an annual capacity of 1,800 tons of bark, the principal part of which comes from Sullivan county; a small part, however, comes from Delaware county. Bark costs seven dollars unloaded on cars. This tannery has been in operation twenty-one years. From Ellenville to Eureka the road is through the valley of the Rondout creek.

Sullivan County.

At Eureka.—The east branch of the Rondout creek joins the main stream. Much of the water of this branch is leased for fishing purposes by non-residents, who have their notices up at frequent intervals along the stream forbidding parties from trespassing on their rights. The valley at all places is narrow and contracted and the hills steep on either side. They are now sparsely covered with a thin growth of saplings, among which old stumps can be seen, giving evidence of a once heavy growth of timber on these hillsides. This valley is said to have been once a great place for hemlock, but the bark-

peelers came along slaughtering the timber for the bark faster than the small water-mills could cut it up, consequently millions of feet went to waste, rotting in the woods, then the fire came and swept through, burning the dead and fallen timber, and with them the woody portion of the soil, so that the future growth of forests was sadly interrupted.

Livingston Manor. — There is located here a wood-alcohol and acetate of lime factory, which has been running seven years. It has twelve retorts and two condensers, and consumes 3,000 cords of hard-wood per year. Beech is considered the best for the purpose, but there is used also birch, maple, oak and chestnut. The products of the factory are wood-alcohol, acetate of lime, creosote and wood ashes. This alcohol is used in varnishes; the acetate of lime is used by white lead manufacturers and in dyeing; the charcoal is used by powder manufacturers, and the wood ashes are used as a fertilizer. The alcohol is worth two and one-half cents a pound, and the capacity of the works is one barrel a day. Fourteen cords of wood are consumed in producing it. Parties running it pay two dollars a cord for wood delivered in the factory yard, and buy of farmers living in the vicinity. There is another factory five miles up the Willewemoc, which has sixteen retorts and has been running five years. It consumes 4,000 cords of wood a year. At each burning the Livingston Manor factory use fourteen cords of wood. The retorts are filled once in twenty-four hours. The company has to carry a year's stock of wood. A gas which is generated in the retorts is used to light the factory nights. The charcoal sells for thirty seven and one-half cents a sack, which contains four bushels. The charcoal pays for the wood and for the labor. The ashes from under the retorts are worth twelve cents a bushel. In Delaware county, just west of the Sullivan county line, there are located a large number of these wood-acid factories. These are at East Branch, Fish's Eddy, Trout Brook, Westfield, Reed's Creek and Rock Rift. The wood supply for these comes all from Delaware county. Scoop and bowl makers are scattered through the upper part of the town of Rockland, Sullivan county. They also make the oblong butchers' trays. These articles are made from the choice part of the tree, by a class of poor farmers living in the mountain-wooded districts. Trays are sixteen, twenty and twenty-four inches long; scoops are worth about four dollars

and fifty cents per dozen. The manufacturers trade them at the store for groceries and necessities. There are several small turning establishments near the north line of the county, where the trays are made by machinery. There are five of these mills on the Beaver kill and its tributary, Shin Creek, and two on the Willewemoc. These will produce two hundred to five hundred dozen each a year; total yearly product, about 2,000 dozen. A twelve-foot log, nineteen inches in diameter, will make one and one-half dozen trays. A merchant says: "We handle about 40,000 hoops and buy some trays, bowls and scoops. We take them in trade. I bought, individually, 200 acres of timber land in the town of Rockland, from which I peeled 660 tons of hemlock bark. I paid twelve dollars an acre for the land. There is a basket factory in the town of Marlborough, which uses 120 to 125 thousand feet of selected birch a year, shipped mostly from here. There is a tannery at Rockland using 1,200 cords of bark a year, and is the only one in the town of Rockland. Tanning has all been abandoned here within ten years. The largest and next to the largest were abandoned during the last two years."

The turning shop at Livingston Manor manufactures base-ball bats, Indian clubs, dumb-bells and everything in the wood turning line. Bats, clubs and dumb-bells are the main product. There is used, all told, about 800,000 feet in turning these articles; this includes 100,000 feet of ash, with the prospect of using more of this timber from now on, and are gradually working into that alone. There is also used about 50,000 feet of basswood, the balance of the amount is birch, beech, maple and some cherry, of the latter say 25,000 feet. The timber all comes from within a couple of miles of the factory, except the ash which is got all along the line of the railroad where it can be picked up. They ship a great many roller-blocks, for paper rolls, to England. These are all hard maple, six and one-fourth inches in diameter when turned and twenty-six inches in length. All stock of this kind has to be perfect and free from checks and bad spots. They ship from thirty to forty car loads a year, during the three cold months; they cannot ship in warm weather as the timber checks under the influence of the heat. They cut most of their beech, birch and maple lumber from the log, and pay five dollars a thousand for logs delivered in the yard. Standing timber on the lands about here is worth from one dollar and fifty cents to two

dollars and fifty cents a thousand feet, board measure, and timber lands are said to be worth from four dollars to ten dollars an acre. There is another shop of the same character at Westfield, about six miles below here, with about the same consumption of timber as this. The factory here manufactures 1,200 to 1,500 gross of bats, 10,000 pair of Indian clubs, and 25,000 pair of dumb-bells a year. Stock for bats is two and five-eighths inches square by thirty-five to thirty-eight inches long for men's sizes and thirty to thirty-two inches long for boys' sizes. They use cull roller blocks for making Indian clubs and dumb bells. The proprietors of the factory own three hundred acres of standing timber; in cutting it off his lands he clears everything. Stock is cut down to ten inches on the stump and what is left from this, is cut up into cord-wood; the price paid here is two dollars and twenty-five cents a cord delivered on cars. Good timber land, if cut for cord-wood alone, will average forty cords to the acre. The proprietor of the shop thinks they can run on the present supply of timber about fifteen years longer; they have already been here fifteen years; they used to buy timber for four dollars a thousand, but since for the last five years they have been clearing the timber up so fast the price has risen. For the last three years dealers have started shipping out round timber and cord-wood and are increasing their business every year. They use in the turning shop from 100,000 to 107,000 feet a year of hemlock for boxing goods which is worth from nine dollars to ten dollars a thousand, and has been as high as twelve dollars. They use three turbine wheels, a twenty-four, thirty-six and forty inch, working on a nine foot head of water obtained from Willewemoc creek.

A timber and wood dealer says that 50,000 cords will about represent the amount of cord wood shipped out of this county by way of the New York, Ontario and Western Railroad, and by the Delaware and Hudson Canal, and that of this amount the railroad carries about two-fifths. Most all of it goes to Haverstraw to supply the immense brick burning establishments.

Acid Factories. — The Middletown Argus says: "The decline of the lumber business along the line of the Ontario and Western Railroad in Sullivan and Delaware counties was followed by the introduction of a new business, which was intended to utilize the hard wood forests which clothed many of the hills and mountains

after the supply of hemlock had been exhausted. This new business was the establishment of factories for the manufacture of pyroligneous acid or wood-acid, and what is called in commerce, acetate of lime. The acetate is produced by the destructive distillation of wood in closed retorts, and the incidental products of its manufacture are wood-alcohol and charcoal. The pioneers in the business made large profits, for the demand for their products exceeded the supply, but it was not long before there were so many engaged in the business that the market was overstocked, and the prices declined to a point below the cost of manufacture. The result was, of course, that many factories shut down. About two years ago the market for the products of these factories began to improve, and the improvement has continued ever since, until now prices for acetate and alcohol are more than double what they were two years ago. At present prices the business affords a good profit, and if the present conditions continue, good times for the owners of the factories will mean increased activity and employment for woodchoppers and others dependent upon them for employment."

Ulster County.

Shandaken.—Is on the Ulster and Delaware Railroad. A chair factory, about a mile below the station, on the north side of the Esopus creek, consumes about 500,000 feet of hard wood timber a year.

Chichesterville.—The Chichester Chair Company is located here on the Stony Clove creek. It uses 2,000,000 feet of logs and lumber annually, at a cost of \$2,400; will use probably more than that this year. All kinds of hard wood are used, also spruce and hemlock for packing cases. The company owns about 5,000 acres of woodland in Woodstock and Shandaken, Ulster county, and Hunter and Lexington in Greene. It cuts timber down to eight inches on the stump, and estimates the yield at 10,000 feet, board measure, to the acre. It has very little trouble from fires. Eight or nine years ago two serious fires occurred, which, however, were controlled, but not until serious damage had been done and the factory and buildings threatened. Timber costs six dollars a thousand cut on their own lands and delivered in the yard. For timber bought from outside it pays seven dollars a thousand if there is not one hundred feet in the log, and eight dollars if there is. The refuse from the factories is burned

under the boilers and no coal is used. The company had rather buy the logs than the sawed lumber, as it can get the slab from the former which is good turning stock. It pays ten dollars a thousand for green lumber and twelve dollars for dry. Standing timber is appraised at one dollar and fifty cents to two dollars per thousand. Dry ash lumber is worth twenty dollars per thousand. The company realized last year \$900 in rentals from blue stone quarries. It clears some land for hay and cut enough last year to supply its needs. It buys timber rather than use its own; which it reserves against a rise in the market. It makes finished chairs, cradles and settees. A great proportion of the work goes to South America, Cuba and Panama. Since being in business here the water-power has failed wonderfully; formerly it used water-power alone, now it uses part steam. Mr. Chichester planted about one-fourth of an acre two years ago with black walnuts; the young trees are now about five feet high and one inch in diameter, and healthy looking; they grow rapidly. A stream coming down from the west has its water-shed now grown up pretty well with small stuff, and the summer flow of this stream is greater than that of the main stream, of which it is a tributary. On the main creek the floods are often violent and disastrous and are believed to result from cutting off the timber on the steep hillsides of the valley. Twenty-five years ago, rough stock only was manufactured and carted to Rondout. The railroad had not then been built.

Phœnicia.—Two mills run by water-power.

Fox Hollow.—One mill run by water-power. Blue stone piled ready for shipping.

Shandaken.—A chair factory.

Big Indian.—One mill run by water-power.

Pine Hill.—One mill run by water-power.

Summit Station.—Two charcoal pits, not now in use.

Dry Brook.—Is the name of a section of country and not of a village. The brook is a rapid stream occupying a narrow valley between steep hills. There are four saw-mills on this stream, two run by water power and two by steam. These mills saw some hemlock of which there is a small amount left in remote localities, but saw mostly hard wood for chair stock and piano bars, which find a fair market along the Ulster and Delaware Railroad. The State lands in this vicinity are reached from the Dry Brook

road ; they are covered with a thin growth of hard wood, with an occasional clump of hemlock ; some of the maple and birch is very large and of fine quality. The lots lie, for the most part, on the tops and further sides of the ridges, and aside from an occasional cherry or ash tree stolen, are unmolested. The Quaker Clearing near Balsam Lake, covers about 1,000 acres. It has been used as pasturage for stock, but is unoccupied at present. There originally stood an old forge about four miles up from the mouth of the brook. Charcoal was burned many years ago in that locality ; it is not known where the ore came from.

Piano-bars are made from the best and straightest grained maple, and are cut two and one-half inches by four inches, by six feet in length. Chair stock is cut from almost any kind of hard wood, and it is not necessary that the grain should always be straight ; birch, as well as maple, is sawed for this ; the dimensions of stock are two inches by two and one-half inches, by eighteen inches long. All the poplar has been cut out of this valley and used in the manufacture of excelsior.

Mount Pleasant.—Has two saw-mills run by water power ; railroad ties and hoops shipped from here.

Boiceville.—Has one saw-mill run by water power ; railroad ties and cord wood shipped from here.

Shokan.—One saw-mill run by steam ; one tannery and one set (3) of charcoal pits ; railroad ties are shipped from here.

Broadhead's Bridge.—Has one mill for sawing bluestone ; railroad ties, mostly chestnut, and considerable cord wood are shipped from here.

West Hurley.—Has one steam mill for sawing bluestone.

Ellenville.—From Kingston to Ellenville, by way of Cornwall, the distance is about eighty-four miles, while by the stage route up the valley of the Rondout creek the distance is only about twenty-eight miles. There has been talk of building a railroad through this valley, which would certainly prove a great saving both of time and money to the people of Ellenville in going to and from Kingston, the county seat. A resident of this place says he owns 3,000 acres of land in the town of Wawarsing in a solid chunk ; he is much troubled with persons who burn over his land in order to promote the growth of whortleberries with which they abound, and hopes the State will be able to stop this evil as his lands are about ruined.

A local surveyor says that the 160 acres owned by the State in Great Lot 24 of the Rochester Patent lies on the side of the Shawangunk mountains, about two miles down the Sandberg from here. The land has some good pine sawing timber on it, but most of the hoop-pole stuff has been stolen off. The lot is not near any road.

A lumber merchant says: "We handle three or four million feet of lumber a year, the great majority of which comes from Sullivan county; the shipping points are Rockland and Livingston Manor. The lumber is mostly hemlock, with some maple and chestnut; we handle some pine, cherry and ash; we will handle this year, perhaps, 200,000 feet; hemlock lumber costs eleven dollars on cars; maple, fifteen to twenty dollars; chestnut costs eighteen dollars; cherry, twenty-five dollars; pine, twenty dollars, and basswood eighteen dollars. The pine is of an inferior quality, having about thirteen knots to the square foot. The whortleberry crop on the Shawangunk mountains amounts to \$4,000 a year, gathered within three or four miles of this place. These pickers burn over the mountain every year in some portion of it to improve the yield. The berries go to New York by rail, sometimes three carloads a day; they are shipped in one-half bushel boxes."

The Ellenville glass-works use from 1,000 to 2,000 cords of wood a year; most of it comes from Greenfield and Oak Ridge or within a radius of about eight miles from here, all from this county and town of Wawarsing; none comes by rail, as the supply can be kept up from what is drawn in by farmers and offered for sale; the price paid is three dollars a cord for hard wood; some hemlock is bought, but mostly hard wood is issued. The material for the glass is a silicious rock, containing about ninety per cent of pure silica; it is dug on the Shawangunk mountains, opposite here, and crushed in the factory; a twenty horse-power engine will crush eighteen tons of the rock a day. Another company has been formed here which will sell the powdered rock to glass companies. They claim to have discovered a bed of rock which analyzes 99.63 per cent of pure silica, and are putting up a plant to crush the rock.

Another lumber merchant says: "We handle on an average 1,000,000 feet of hemlock a year, three-fourths of which comes from Parksville, Livingston Manor and Rockland, in Sullivan

county, and the balance from Albany; we have also been getting a small percentage from Pennsylvania. We handle 1,000,000 feet of pine, all coming from outside places, as Oswego, Albany and Michigan. Also 50,000 feet of Georgia pine, 50,000 feet of white-wood, 1,000,000 lath, mostly from Glens Falls and Pennsylvania; 2,225,000 shingles, largely from Oswego. We merely handle sawed lumber and do no manufacturing. We manufacture, four miles below here, at Wawarsing, about 50,000 bushels a year of lime for fertilizing and tanners' use. We own six acres of stone quarry within a short carting distance of our two kilns, of a capacity each of 100 bushels of unslacked lime a day."

One of a firm which deals in wood said: "We handle about 9,100 cords of wood, which comes from Wurtsborough, Brownsville, Westbrookville and Summitville, in Sullivan county; we pay about three dollars per cord. We handle 200,000 railroad ties, and pay thirty cents for good and half-price for seconds. We handle 500,000 feet of chestnut fence-posts; also a limited number of river posts, cut eight, ten and twelve feet in length, the price of which is one cent per foot; they are used in New York for cellars; only chestnut timber is used. We handle 1,000,000 hoops; we own a mill at Livingston Manor, of about 6,000 to 8,000 feet per day capacity."

Ellenville Pottery.—"This concern uses 250 to 275 cords of wood a year; it is all soft wood, as hemlock and pine, and is cut within a radius of ten miles around here; farmers bring in two, three, four or five cords apiece; the price paid is two dollars a cord."

A hoop dealer says: "Hoop makers begin to shave about the first of October and quit the first of April. The timber used for hoops consist of chestnut, rock oak (red), soft maple, birch, hickory, white oak, black ash and quite a good deal of willow, and is cut in lengths from four and a half to eight feet; the principal part are six and a half feet in length, and is all small second growth, one and a half to three-fourths inches in diameter. A large portion of the hoops sold here comes from the town of Wawarsing. Hoop-pole stuff grows up in three or four years, that is, lands cut over reproduce a new crop in from three to four years. I will handle about half a million hoops this year. I own lot 131 in town of Denning, near Parksville." Lands in Denning are held at from two dollars to ten dollars per acre.

Another hoop dealer says : "The hoop-pole range takes in about from here to Allegeterville, and includes both sides of the mountains for a distance of sixteen miles ; this territory will produce about 45,000,000 of hoops a year from Ulster and about 10,000,000 from Sullivan county. The Shawangunk mountain produces about two-thirds of the Ulster output. The Sullivan county output comes from Wurtsborough. I will get 2,000,000 hoops this year from Claryville in the town of Denning, Ulster county. Denning produces, of all kinds, about two or two and one-half millions a year, all of which go to the Burden Iron and Steel Works at Troy and are used on horse-shoe kegs. The cement manufacturers made 2,250,000 barrels of cement last year and you can count twelve hoops used on each barrel. The staves for these barrels come from the east. Head'ngs come from here, near Wawarsing, and are made of all kinds of timber, both hard and soft. The number of head'ngs are two to each barrel and there are three pieces to each head, the dimensions of which are five-eighths inches thick by eighteen inches square, worth four cents a set. Heading stuff is cut square and turned up to sixteen inches diameter. The farmers about here think as much of their hoop-pole lots as they do of their grain fields. I have known of twenty-five to thirty hoop-poles to grow from one chestnut stump. Timber when cut low down gives a far better yield of stump shoots. Hoop-pole lands, if good, are worth from ten dollars to twenty-five dollars per acre ; that depends on the situation and soil. Scrub oak is not fit for hoop-poles. Where a soil produces chestnut, maple or oak, it is more valuable for hoop-pole growing than for agriculture. Such lands will sell, in cases, for more than the timber is worth. Ten years ago last summer I was the first to handle hoop-poles in this locality, and have averaged from that time five to ten million hoops a year. Another dealer has handled a similar number for the same period. Another has handled two million a year. Two others each one and one-half million a year for the last ten years. A New York party has handled five million a year for the last five years. Another three million a year. The bulk of this output comes from the Shawangunk mountains. The hoop-pole industry will produce more money than the whole grain crop of Ulster county. Hoops are bought by the thousand, and the average price for the last ten years has been about four dollars per thousand for all kinds. Headings are sawed

in this town (Wawarsing) and in the town of Rochester; the bulk of them come from Rochester. Headings are sold by the set; the average price for ten years has been four and one-half cents a set."

A mill owner says: "I own a lot in Greenfield and am cutting it off this year; the lot contains fifty-six acres and will yield about 400,000 feet of timber. On the Willemoc lands, in Sullivan county, the average cut of beech, birch and maple will be 25,000 feet per acre. Veneer stock comes from Sullivan county and is measured by the square foot when cut up into chair-bottom sizes, and is sold by the thousand square feet. The average price for the past year has been twenty shillings per thousand. The ratio of veneer to logs is fifteen thousand feet of veneer to one thousand feet in the log. The capacity of my mill is one hundred to one hundred and fifty feet of logs. The market is in New York and I ship from here by rail. I think private lands could be bought for twenty shillings an acre. I own fifteen hundred acres which I would sell at the above figures."

Ellenville Tanning Company.—Annual capacity is 2,000 cords of bark; supply comes from Delaware county, principally from the town of Hancock. The company run another tannery at Wawarsing of a capacity of about 1,500 tons of bark a year. The supply for this tannery comes from the town of Denning, Ulster county. Bark is worth five dollars and fifty cents and is bought by the ton; some extract is used. The State land can be bought at one dollar and fifty cents per acre. This company sold, recently, 600 acres in Denning at the above figure.

At *Napanock*.—There is an ax factory, tobacco-knife factory, straw-paper mill and rake factory. The latter concern buys oak in the log and saw and season themselves. The oak is cut in the immediate vicinity and drawn in by the farmers. There are four other mills between Napanock and Eureka, on the Rondout creek, all small saw-mills run by water power, each of about 100,000 feet capacity a year, but are run only part of the time and supply merely a local demand.

Lackawack.—Has a small excelsior mill, using about 500 cords of wood a year. The merchantable timber here is mostly chestnut, which is sawed chiefly into railroad ties and shipped out to the places along the canal and railroad.

Wawarsing.—A manufacturer says: "I use water power in my mill from eight to nine months of the year. Previous to 1863, I used water power entirely, but since then have been obliged to use steam part of the year. The water power is derived from the Vernoooy kill which heads a little north-east of lot 1 in the Pell tract. I use 800 cords of wood a year, some of which comes from Neversink, Sullivan county, and some from Wawarsing and Rochester in Ulster. I pay five dollars for 144 cord feet. The wood is cut four feet six inches in length. I buy down to three and one-half inches diameter, and cut down to five inches diameter on the stump. Eight or nine cords of wood make a car load. I own 12,000 acres of timber land, and the timber on other tracts; 1,600 acres of this is in the Pell tract and some in Vernoooy's survey. I have another mill at Boiceville, Ulster county, and consume there 1,600 cords of wood a year; my land is located in the town of Shandaken, Ulster county, and in the town of Andes, Delaware county, about one and one-half miles from Andes village. I can furnish the number of all lots owned. Lands from which the timber has been cut off, as a rule, are not used for agriculture, but are allowed to grow up again and then cut over for hoop-poles. This practice keeps the water-sheds in a denuded condition and spoils the water supply."

The industries of Ulster county were never more flourishing than they have been the past year, with a prospect for as busy a season the ensuing year. The largest of these are blue-stone, brick, cement and lime. To these may be added the hoop, heading and cord-wood productions. The hoops and headings are used by the cement and lime manufacturers. About 30,000,000 hoops are used in these two branches alone in this county. This great number of hoops is mostly gathered, prepared and taken to market in the fall and winter when other work is scarce. The cord-wood is used principally by the brickmakers, some of whom use from 4,000 to 5,000 cords in a season. These several items make a tremendous business.

There are other industries in this county. At Ellenville there are glass works and a large leather manufacturing establishment; at Napanock are two paper mills and an axe factory; at Mill Hook, in Rochester, is a paper mill, and in Rochester all the millstones to grind the cement and lime are made; in Marbletown near Stone Ridge is a paper mill; in Saugerties a paper mill, turning out ten

tons of white paper a day; at Wallkill, town of Shawangunk, a paper mill making two tons of white paper a day. In Olive there are excelsior, pulp and leather manufactories. In Shandaken there are two chair factories, where the logs are rolled in at one end of the establishment, and chairs, cradles and settees come out at the other at the rate of one a minute. At Marlborough there is a berry crate and basket manufactory for shipping fruit to market. Ulster county is likewise a great fruit-raising county, not to mention the immense proportions of the summer boarding business.

There is rarely found in the Catskill region an abandoned homestead, which in itself is good evidence that a continuous cultivation does not exhaust the soil, and that the farms are productive enough of wealth to enable the farmers to purchase the necessary fertilizers. This distinguishes this wild region from the similar one in the Adirondacks, where deserted homesteads are met at frequent intervals, and in places the dilapidated remains of whole villages, which for some reason or other were abandoned many years ago. The Catskill region as a whole has a good soil and friendly climate, which the Adirondacks can scarcely be said to possess.

CHARLES F. CARPENTER.

RAQUETTE LAKE DISTRICT.

TOWNSHIP 40, TOTTEN AND CROSSFIELD'S PURCHASE, HAMILTON COUNTY.

In October, 1886, Mr. C. B. Tillinghast, then a forester, made the following report to the Commission, after a personal examination of the Raquette lake region :

As far as it has been practicable in the brief interval that has elapsed I have examined the timber in Township 40 and find it in better condition than I have known it in several years past. While there has been some lumbering for the use of campers and quite a large amount of timber has been manufactured into lumber for the construction of new cottages, etc., it has not been so indiscriminate and has not occasioned the damage caused in former years, when whole acres of forests were cut over without regard to size or quality of the timber.

The mere fact of the existence of a commission to protect the timber lands of the State and the public notification of its intention

to carry out necessary provisions for that purpose has kept marauders in check and induced the better class of the natives to exercise some discretion in cutting timber for their own use. Where hard wood is required the spruce and hemlock is allowed to remain and protect the soil from drying out and preventing new growth of timber, and where the soft wood is cut only large trees are taken, the small ones being left to prevent the occupation of the ground by the poplar, which seems to take possession of the soil wherever denuded by lumbering or fire.

This discretion is mainly the result of experience, but may be converted into judicious management if properly encouraged by the Commission (by means of disseminating forestry literature, etc.) and made to form a valuable auxiliary in their work.

Forest fires seem this year to have been infrequent, and in this township have been very insignificant and occasioned no injury of consequence to the forest. Scars, and patches of partly denuded lands are not infrequent, especially in the northern part of the township, but none of them are of very recent date and in most cases the ground has had ample time to recover from the effects of the scorching to which it has been subjected and is now quite densely covered with a second growth of hardwood.

Where the fires have been most complete in their ravages the poplar has sprouted in the first place, followed by maple and birch and lastly by the spruce, but the latter seldom gains repossession of the soil when dispossessed by fire, probably owing to lack of moisture and thinness of the soil. This condition prevails along low lands near the water, except where moisture can be drawn from the lake through the roots, and there the cedar gains over all other trees.

Farther inland the maple and beech take precedence until the steeper slopes of the high hills in the background are reached, when the pine and hemlock once more assert their supremacy.

From the above it will be seen that the amount of timber on these lands must vary greatly as it does, in character and size, but where the soft woods have not been much disturbed the ground is still densely covered and much of the timber is of great size. Observation in many different directions seem to show the number of trees to the acre to vary from 150 to 300, such as would cut into merchantable logs of not less than eight inches in diameter

The whole shore of East inlet and Marion river was heavily wooded with pine timber, mostly hemlock, spruce and pine, which would cut, probably, four cords to a tree or 1,000 cords to the acre, as much as seven cords having been cut from a single tree in this tract.

This valuable timber has been largely cut off by individuals for the use of the hotels and steamboat company at Blue Mountain lake.

South Bay is also surrounded by considerable large timber on all sides until the west end of the bay is reached ; here low, swampy ground covered with tamarack prevails.

On the west shore of the lake bold rocky banks covered with cedar, birch and maple are interspersed with spruce and hemlock until Constable Point is reached, where whole acres have been denuded, and are now but partly covered with second growth hard wood. Most of this, however, is private property.

Farther inland heavy timber is found, which prevails until Baxter Bay is reached on the north, with occasional patches of tamarack along Beaver and Tucker brooks and some hardwood along the shore. The lower hills on all sides show a large amount of hardwood on their slopes with pine, spruce and hemlock crowning their heights.

West and Bald Mountains and the high range of hills on the east side of North Bay are partly denuded by fire, wind, the wash of the rains and melted snows, leaving only bare rocks devoid of soil or moisture. On the east shore is also much good timber, averaging 200 to 250 trees to the acre.

The streams have been gradually filling up with soil washed out of the woods by spring freshets, and this soil, converted into rich muck, is becoming covered with alders and cranberries, while much of the timber ruined by the floods has been allowed to remain where it has fallen, to the great loss of beauty and the impediment of navigation.

The only extensive clearings on this lake are on Kenwill's, Wood and Indian Points. But one of these is now cultivated ; those on Wood and Indian Points having been abandoned. There are no clearings on State land, except very small patches around a few permanent camps and dwellings. The principal of these are at Hathorn's, Whitney's, McBrower's and Dunning's on South Bay ; Durand's on Osprey Island and Hasbrouck's in North Bay.

There are fourteen islands in Raquette Lake ; in North Bay one (claimed by E. Hasbrouck, N. Y.) ; in Great Bay two, not occupied or claimed as far as known ; off Bluff Point one, claimed by F. H. Stott, Stottville, N. Y. ; off Indian Point one, not occupied ; in East Inlet Bay, Osprey Island, and one other claimed and occupied by C. W. Durant, New York city ; St. Hubert's Island claimed and occupied by the Episcopal church ; two slands not occupied or claimed as far as known ; Wood and Big Island occupied by Doctor Gerster, of New York city ; High or Pine Island claimed by John R. Strong, New York city ; and two islands in South Bay not occupied.

These islands are all in good condition, not heavily timbered, with the exception of Wood and High Islands, and those claimed as above have camps upon them ranging in value from \$500 to \$3,000. Of shore camps there are in South Bay four — Hathorn, McBrower's, Whitney's and Dunning's ; East Inlet Bay, one (name not known) ; East Bay, three (guides' camps) one owned and occupied by Mrs. McCarthy, of Syracuse ; Beaver Bay, one, owned by Alonzo Mix, guide ; one now building, claimed by Joseph Bryere, Raquette Lake ; two on Indian Point (guides) ; two in Great Bay, owned by Charles Blanchard, Blue Mountain Lake ; one in North Bay, owned by F. Hasbrouck, New York city, who also claims Beach's Island in the same bay (State land, though marked on the maps as private). In addition to these are three hotels, Kenwill's, Bennett's and Hathorn's, the last one of the three occupying State land.

This being the largest, and in many respects the most beautiful of the lakes, is rapidly being occupied by parties who wish to establish permanent camps, and whose presence is rather a safeguard than otherwise, bringing the owner as it does a sense of personal interest in the protection of his own and neighboring lands.

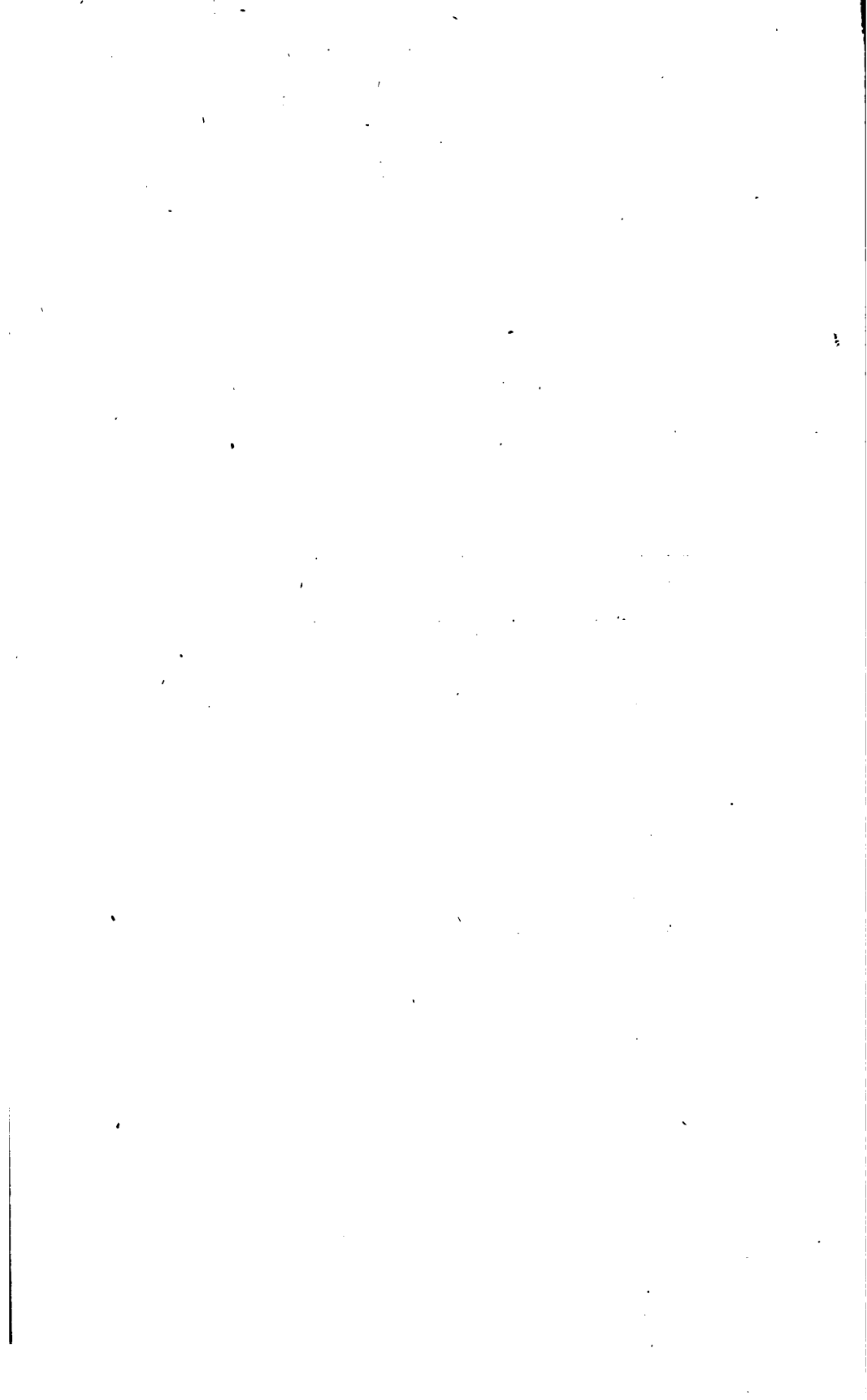
On the other hand casual and intermittent, or perhaps better, professional campers, require attention. Most of the pleasure camping is now (October) over, but there will be some sportsmen in camp for a month yet ; the most dangerous class, however, is the gum pickers, who are now flocking into the woods, and who wander from place to place leaving smouldering fires wherever they sleep. As for those parts of the township lying about this lake, no better protection can be guaranteed than that of the owners or

occupants of permanent camps, provided that they are secured in their holdings and made to understand that protection is a condition of permanency. In this connection, I would respectfully urge the granting of leases to parties who have made investments of this kind, and to all who will erect permanent camps of sufficient value to insure co-operation with the Commission in the enforcement of the law.

Such persons will thus be enlisted in the service of the State, and can and will do much to prevent spoliation and retain these woods in more than their present beauty, as well as usefulness in the preservation of the waters which form so invaluable a treasure in the lap of the Empire State.

CHARLES B. TILLINGHAST.

SUPPLEMENT.



SUPPLEMENT.

APPENDIX A.

Jurisdiction Over the Lake George Islands — Opinion of the Attorney General.

ALBANY, November 27, 1886.

HON. TOWNSEND COX, *President of the Forest Commission:*

DEAR SIR. — At a meeting of the Commissioners of the Land Office, held on the 10th day of November, 1885, Delavan Bloodgood made application to be appointed custodian of one of the islands in Lake George, known as the Hen and Chickens islands, which application at that meeting was laid upon the table.

At another meeting of the Commissioners of the Land Office, held on the 1st day of December, 1885, the application of Dr. Bloodgood for the custodianship of these islands in Lake George was taken from the table, and the applicant was appointed custodian or agent on the part of the State, for the purpose of preventing trespasses upon the Hen and Chickens islands in Lake George, said appointment to continue during the pleasure of the Commissioners of the Land Office, without expense or cost to the State.

At a meeting of the Commissioners on the 10th day of December, 1885, John H. Bergen, Esq., made a similar application to be appointed custodian of Huckleberry island in Lake George, which application was, at that meeting, granted by the Board and the appointment made.

It is fair to say that this action was taken by the Commissioners of the Land Office without attention being called to the legislation of 1885, appointing Forest Commissioners and regulating the care and custody of forest lands in certain counties of the State.

At a meeting of the Commissioners, held on the 19th day of February, 1886, Mr. Bergen presented an application asking the consent of the Board to erect a cottage and the necessary appurtenances thereto, and an ice-house, on the island in Lake George

known as Huckleberry island, of which he was recently appointed custodian. At the same meeting Dr. Bloodgood presented a similar application for the erection of a cottage and the necessary appurtenances thereto, and an ice-house, on the island in Lake George known as the Hen and Chickens, of which he was recently appointed custodian.

At a meeting of the Board held on the 20th day of January, 1886, you, as President of the Forest Commission, appeared before the Board for the purpose of calling attention to the fact that the powers of the Commissioners of the Land Office over the islands in Lake George were repealed by the Act of 1885, and that since the passage of that act the sole control and jurisdiction thereof was vested in the Forest Commission.

The matter was thereupon referred to the Attorney General for his opinion, who reported to the Board on the 10th day of February, 1886, in a short opinion, wherein the power and jurisdiction of the Commissioners of the Land Office to pass the resolutions hereinbefore referred to was in substance affirmed.

At a meeting of the Commissioners of the Land Office, held on the 4th day of March, 1886, presumptively on the strength of this opinion, consent and permission was granted to John H. Bergen and Dr. Bloodgood to erect the cottages and necessary appurtenances mentioned in the applications already referred to, which had been tabled until this meeting. The Secretary of State, Attorney General, State Engineer and Speaker of the Assembly voted in favor of granting the permission; the Lieutenant Governor, Comptroller and Treasurer voted against it.

Application has been made to me by counsel representing the Forest Commission, for the purpose of procuring a re-examination of the questions involved. In view of the fact that the opinion of the Attorney General, addressed to the Commissioners of the Land Office on the 10th of February, 1886, was founded upon such an examination of the question as he was then able to give it, and was without an opportunity on the part of the Forest Commissioners to be heard, I have concluded to give the question further examination, and to this end have heard argument orally and in writing on the part of the counsel representing the Forest Commission.

The Commissioners of the Land Office, under the Revised Statutes, had jurisdiction over and control of all lands belonging to the

State, except where the care and superintendence thereof was vested in some other officer or board. The islands in Lake George had not been intrusted, at least prior to 1885, to the care or superintendence of any other board or officer. The first limitation upon the power of the Commissioners of the Land Office is contained in chapter 297 of the Laws of 1876, wherein it was provided that no grant or lease of any of the islands in Lake George, or of any land on any of said islands, shall be made by the Commissioners of the Land Office, or by any board or officer of the State, until the further direction of the Legislature, and any such grant or lease hereafter made, without express direction of the Legislature, shall be null and void.

On further examination, I am convinced that chapter 497 of the Laws of 1880 did not grant to the Commissioners of the Land Office any further or greater powers over or concerning the islands in Lake George than they had previously possessed under the provisions of the Revised Statutes already referred to.

The act of 1880, it is true, recognizes the jurisdiction of the Commissioners of the Land Office over these islands; but the object of the legislation contained in that chapter seems to be to provide remedies of a criminal nature against any person who should remove, deface or injure the trees, shrubs or bushes standing or growing on any of the islands in Lake George belonging to the State, or who should erect any building thereon.

Prior to the passage of chapter 283 of the Laws of 1885, entitled "An act to establish a Forest Commission and to define its powers and duties and for the preservation of forests," which was passed on the 15th of May, 1885, the Commissioners of the Land Office had, without question, jurisdiction over these islands and were charged with their care and custody.

The question is, were the powers which the Commissioners of the Land Office possessed prior to the passage of that act, repealed by the act of 1885, and the powers and duties theretofore possessed by the Commissioners of the Land Office transferred by the force of the legislation to the Forest Commission.

The seventh section of that act provided "that all the lands owned or which may hereafter be acquired by the State of New York within the counties of Clinton (except the towns of Altona and Dannemora), Essex, Franklin, Fulton, Hamilton, Herkimer, Lewis, Saratoga, St. Lawrence, Warren, Washington, Greene, Ulster

and Sullivan shall constitute and be known as the forest preserve." All the islands in Lake George are within the territory named in this section.

By section 8 of the act it is provided "that the lands now or hereafter constituting the forest preserve shall be forever kept as wild forest lands. They shall not be sold nor shall they be leased or taken by any person or corporation, public or private." It is provided in the next section that "*the Forest Commission shall have the care and custody and control and superintendence of the forest preserve; it shall be the duty of the Commission to maintain and protect the forests now in the forest preserve, and to promote as far as practicable the further growth of forests thereon.* It shall also have charge of the public interests of the State with regard to forests and tree planting, and especially with reference to forest fires in every part of the State. *It shall have, as to all lands now or hereafter included in the forest preserve and subject to the provisions of this act, all the powers now vested in the Commissioners of the Land Office and in the Comptroller as to such of the lands as are now owned by the State.* The Forest Commission may from time to time prescribe rules or regulations, and may from time to time alter or amend the same, affecting the whole or any part of the forest preserve, and for its use, care and administration; but neither such rules or regulations nor anything herein contained shall prevent or operate to prevent the free use of any road, stream of water as the same may have been heretofore used, or as may be reasonably required in the transaction of any lawful business."

By the eleventh section of the act, the Forest Commission were empowered to bring, in the name of or in behalf of the people of the State, any action to prevent injury to the forest preserve, or to prevent trespasses thereon and recover damage for such injury or trespass, and to recover lands appropriated forming part of the forest preserve or occupied or held by persons not entitled thereto, and in all other respects for the maintenance and protection of the forest preserve, which any owner or holder of lands would be entitled to bring.

I am persuaded that these and other provisions of the Act of 1885, are inconsistent with the existence of any power or duty in the Commissioners of the Land Office touching the lands of the State in

the forest preserve. Although the general provisions of the Revised Statutes conferring upon the Commissioners of the Land Office jurisdiction and control over all lands belonging to the State, were not in express terms repealed, it must, I think, be held that this power and control was repealed by implication. The care and custody conferred by the Revised Statutes upon the Commissioners of the Land Office related only to such lands of the State as had not been confided by law to the care and custody of some other officer or board.

The act of 1885 does expressly give the care and custody of the forest preserve to other officers and to another board, viz., to the officers or board created by that act which was thereafter to be known as the Forest Commission. From the time of the passage of that act on the 15th of May, 1885, the jurisdiction of the Commissioners of the Land Office over that part of the public domain known as the forest preserve, and which is particularly described in section 7 ceased, and thereafter the care, custody and control of this preserve was vested in the Forest Commission.

From the views already stated, it follows that the opinion expressed in my communication to the Commissioners of the Land Office of February 10, 1886, was based upon a mistaken idea of the statutory law applicable to the case. I think it is by no means clear that the Commissioners of the Land Office ever had the right, through an exercise of the power to appoint care takers or custodians of those islands, to confer what was in substance and effect the right to take possession of, build upon, use and enjoy those islands for the purpose of summer residences, in the same manner as if they had been leased or granted to the persons authorized to go into possession. This practice was, I think, prohibited by chapter 297 of the Laws of 1876, and what the Commissioners of the Land Office could not do directly, they had no power to do indirectly by appointing what in the resolutions is called a custodian, who had the right to build, improve, live upon and enjoy the islands substantially in the same manner as he could have done under a lease.

But without considering this point further, it is enough to say, for the purpose of this application, that the care, custody and control of those islands was taken away from the Commissioners of the Land Office by force of the legislation of 1885, and transferred to the Forest Commission.

It may not be necessary or advisable for the Forest Commission to disturb persons now occupying these lands in a proper way upon the faith and the strength of the action heretofore taken by the Commissioners of the Land Office upon applications made in good faith by persons desiring to occupy the islands temporarily and for legitimate purposes. But these are matters that address themselves to the wisdom and discretion of the Commissioners themselves in regard to which I do not desire to make any further suggestions.

Very respectfully, your obedient servant,

D. O'BRIEN,

Attorney-General.

APPENDIX B.

Schedule of Inquiry Governing Forester's Examinations.

Report of	Forester, describing lot No.	;
tract or patent,	township	, town of
county of		

Number of acres in the whole lot.

Number of acres owned by the State.

Date when this lot was last personally examined.

How timbered, thickly or partially?

Any cleared land; if so, how many acres?

Any swamp land; if so, how many acres?

Any waste land, or land whose productiveness has been injured by fire?

Any wild meadow land; if so, how many acres?

Name the kinds of timber in the order of quantity.

How much of this lot is virgin forest?

How much is second growth?

Has the lot been burned over? if so, how many acres were burned?

Has the lot been lumbered over?

If so, what kind of timber was cut?

Who is, at the present time, lumbering in that vicinity?

Is the timber there now, large, medium or small?

State the average height of the trees?

Also the average girth, two feet above ground.

Is there any spruce on this lot? If so, state the average number of trees to the acre.

Is there any hemlock on this lot? If so, state the average number of trees to the acre.

Is there any white pine? If so is it first or second growth?

How many white pine trees to the acre?

Are the corners of this lot plainly marked?

How are they marked?

Are the boundary lines marked and how?

What kind of soil is on this lot?

Is the ground rocky, or well covered?

Is there any stream on this lot? If so, state the name.

What is the average width and depth?

Is there any dam on this stream within this lot?

Is there any backflow, or drowned land?

If so, how large an area is flooded?

Do any roads cross this lot?

Are they highways or "wood roads?"

Are there any buildings on this lot?

Describe the lay of the land on this lot.

If occupied by residents, give their names.

Are there any camps on this lot?

Are the shanties in good condition?

Are the surrounding lands forest, or farm lands?

Who owns the adjoining lots?

In making examination of the timber on this lot, you will please carefully observe in reference to the spruce trees.

1. How many dead spruce trees are on the lot?

2. How many are trees which have reached maturity and died of old age?

3. Are the trees found on mountain sides, in valleys, or in wet ground?

4. Is the dead timber in such an advanced state of decay as to be unfit for lumber?

5. Is it so situated that it can be got out?

6. If spruce trees have died from other causes than old age, state what, in your opinion, caused the death, and the number dead from each cause.

Please add any additional information you may obtain and which may be necessary to a full and complete description of this lot.

This was accompanied by the following letter of

INSTRUCTIONS TO FORESTERS.

In order that the examinations of the State lots may be properly done, your attention is called to the following instructions:

First. Where there is difficulty in ascertaining the location of the lot, diligent inquiries should be made among the nearest residents, or local surveyors, for information regarding the place where the lot corner may be found, and also the sign or objects by which

the corner is marked. Make inquiries regarding the location of the boundary lines ; whether plainly blazed or not, and whether the line is near or crosses some distinguishing feature of the land which may assist in determining its range.

Second. Study your map well, and note the relative position of the nearest streams, roads, lakes, mountains or towns as there laid down.

Third. A corner having been once found, an effort must be made to determine other corners with the aid of a pocket compass and the direction of the lines, together with the distances as marked on your map. If you have been furnished with the field-notes of some survey, you should study those carefully and note any information therein contained regarding the direction of the lines and the distances from corner to corner.

Fourth. The corners and boundaries having been ascertained, or, if failing to do that, you have succeeded in locating the lot so that you are sure of its situation, and that you are on the lot, you will proceed to collect the information necessary to answer clearly and distinctly every question in the list. Write down all your notes while on the spot ; leave nothing to memory ; afterwards, at some convenient time you can copy your notes. Fill them neatly on the question list, in their proper places, and forward them to this office at the first opportunity.

Fifth. When it becomes necessary to count the number of trees to the acre, select in each case a spot where the size and number of the trees is of an average character ; lay off a piece of ground ten by sixteen rods ; walk lengthwise along the middle line of the acre, counting the trees (of the specified kind only) on each side within a distance of five rods. Repeat this operation in different parts of the lot. On a well timbered lot of 160 acres, count at least five acres, selecting them in different places. In answering the questions as to the number of trees to the acre, give the number of trees in each count separately. Omit young trees of less than eight inches in diameter, but where there is a large growth of these young trees (of specified kind) make a note of it.

Remain on a lot as long as may be necessary to complete your work, and go prepared to camp out for several days' stay. When in doubt regarding the meaning of your instructions, or if you need further information to carry out your orders, you should write

promptly to this office regarding the matter, in which case every possible assistance will be rendered to you.

The list of questions must be answered without any evasion or second-hand information, and a continuance of employment will depend wholly upon the ability of the forester to answer the schedule of questions regarding the lots assigned to him and the faithful manner in which he executes his work.

APPENDIX C.

Tabulated Statement of Trespass Cases reported to the Forest Commission, to March 31, 1887.

TRACT OR PATENT, ETC.	Number of township.	Number of lot.	Number of markets.	Number of pieces.	Number of trees.	Paid.	Demanded.
Bethune Tract.....		56			21		
Glen, Bleecker & Lansing		63		700			Suit.
do do		68	1200	8000			
Glen, John, and 44 others patent		87	80 cds. of pulp wood.				
Hoffman Township.....		18					
Jerseyfield Patent.....		8			100		Suit.
do		84			268		Suit.
do		88			50		Suit.
do		89			20		Suit.
do		89			147		Suit.
do		67			15		Suit.
do		67			100		Suit.
do		82			100	\$125 00	
do		82			50		Suit.
do		82			80		Suit.
do		82			50	200 00	
do		82			70		Suit.
Lott & Low's Patent.....		7			15		Suit.
MACOMB'S PURCHASE.							
Great Tract 1.....	14	S.W. $\frac{1}{4}$	2000			5,000 00	
do 2.....	9	{ 40 47 }			162		
do 2.....	8	{ 30 30 }	6.96		{ 8 10 }	8 65	Suit.
do 4.....		337			33	75 00	
do 4.....		990			248		
do 4.....		990			112		
North River Head Tract,		13	51 $\frac{1}{2}$ cds. of pulp wood.				
Old Military Tract.....	9	{ 218 214 }					
do	10	214		160		6 40	
do	10	219	Suit for 50 penalties; judgment.				
do	10	232	20				
do	11	{ 100 184 154 }	1336			1,002 00	
Oxbow Tract.....		293	6				\$150
do		297					Suit.
Palmer's Pur., Gen. All't		3	448 & 100 cds.			200 00	
do do		3	113 & 28 cds.			100 00	\$100
Paradox Tract.....		353	Clearing land.				
do		354	Cut hay.				
354 Paradox Tract..		354	43	18			
do		413	42 $\frac{1}{2}$ & 8 cds. bark.				
Romsenberg Patent.....		52		20		100 00	
Track west of Road Pat.		33	195.95				
do do		34	23.59			114 59	
do do		34	40.34			20 00	
do do		35	6.25			7 69	
do do		36	94 $\frac{1}{2}$ cds. 4 ft. wood.			70 90	

APPENDIX C—(Continued).

TRACT OR PATENT, Etc.		Number of township.	Number of lot.	Number of markets.	Number of pieces.	Number of trees.	Paid.	Demanded.
Tract west of Road Pat.	do	.....	37			2		
do	do	.....	37	88.76	cords 4 ft. wood		\$28 40	
do	do	.....	54	30				\$37 50
Totten & Crossfield's Pur.		14	12	253+				
do	do	14	{ 84 } 88 40	784			478 46	
do	do	14	12		90		18 28	
do	do	16	18		626		49 50	
do	do	16	18		122		24 71	
do	do	16	18					
do	do	16	20	45.60		57		
do	do	16	20			181		
do	do	16	20			9		15 00
do	do	16	21	86.80			221 54	
do	do	16	21	574.1				
do	do	16	21	800				
do	do	16	21	4000				
do	do	16	21	1500				
do	do	16	22 & 23	1017	2717		768 20	
do	do	16	22	100				
do	do	21	107					
do	do	21	108	172.7				
do	do	21	107	44.18				
do	do	21	107	124+				
do	do	21	80	38.55				
do	do	21	107	38.00				
do	do	21	46	94.00				
do	do	25	15	100			125 00	
do	do	25	69	95.64			71 73	
do	do	25	71	115.2	288		58 32	
do	do	26	16	65.00				
do	do	26	17	176.9				
do	do	26	18	418.0	1115		522 50	
do	do	26	20	212.0				
do	do	26	26		206			
do	do	26	{ 26 } 48 49	486+			364 68	
do	do	26	29	125.0			102 50	
do	do	26	30	591.0	1440		443 25	
do	do	26	43	125				
do	do	26	57	45				
do	do	26	58	750.3				
do	do	26	58	20				
do	do	26	{ 67 } 68	250				
do	do	26	71	58.66			439 88	
do	do	26	76	18				
do	do	26	76	280	683		287 50	
do	do	26	81	350				
do	do	26	*74	859.2			644 40	
do	do	26	92	42.00				
do	do	26	98	8.00				

* On this and lot 13, Tp. 16.

APPENDIX C—(Continued).

TRACT OR PATENT, Etc.	Number of township.	Number of lot.	Number of marks.	Number of pieces.	Number of trees.	Paid.	Demanded.
Totten & Crossfield's Pur.	26	93	40.00				
do do ..	26	98	.....	.....	.....	\$25 00	
do do ..	26	101	159.5	.....	.....	119 58	
do do ..	26	94	1.50	3			
do do ..	26	99	150.0				
do do ..	26	103	18.38	.....	.....	18 79	
do do ..	26	118	30.00	90	.....	87 50	
do do ..	27	19	30.00				
do do ..	27	21	.....	50			
do do ..	27	21	.....	.....	30		
do do ..	27	22	.....	.....	140		
do do ..	27	25	1400				
do do ..	27	35	500				
do do ..	27	35	1570 posts.				
do do ..	27	35	.....		68		
do do ..	27	{ 62 } { 63 }	4500				
do do ..	30	11	Cleared land & cut hay.			15 00	
do do ..	30	*13	506.26 +			37 50	
do do ..	30	{ 12 } { 15 }	Cleared land & cut hay.			15 00	
do do ..	30	{ 22 } { 28 }	12.67	.....	.....	950 25	
do do ..	30	1, 2	337.4	.....	.....	67 44	
do do ..	30	2	530.1	.....	.....	290 04	
do do ..	30	3	269.1	.....	.....	184 53	
do do ..	30	10	Cut hay	.....	.....	15 00	
do do ..	30	7	517 | 1440	.....	.....	646 25	
do do ..	32	Und. 1, S. E. 1					
Vrooman's Patent.....	13	.....		27			
Woodhull Tract.....	7, Sub. 6,	.....					\$150
Coll'd from other sources.....						16 18	
Total						\$14,057 09	

* Fifty cords of bark.

APPENDIX D.

Cancellations, Redemptions and Corrections.

The following is a list of lands which the Comptroller has officially notified this office are no longer the property of the State, having been redeemed from tax sales, or the titles having been canceled as provided by law also a list of State lands not included in the first report.

CLINTON COUNTY.

To	Lot.	DESCRIPTION.	ACRES ACQUIRED BY TAX SALE.			Other titles.
			1871.	1877.	1881.	
k Brook.	10	OLD MILITARY TRACT. Township 4. Sub. 7; redeemed.....			100	
Clinton.....	37	Township 3. Subs. 1 and 3; redeemed..		110.29		
do	37	Sub. 1; redeemed			54	

ESSEX COUNTY.

PARADOX TRACT.

North Hudson ..	402	N. W. Cor Square; canceled	70			
-----------------	-----	----------------------------	----	--	--	--

TREMBLEAU TRACT.

Chesterfield.....	15	E. P't; redeemed.....			50	
-------------------	----	-----------------------	--	--	----	--

SOUTH TRACT OR STOWER'S SURVEY.

Lewis	12	E End	22			
-------------	----	-------------	----	--	--	--

FRANKLIN COUNTY.

OLD MILITARY TRACT.

Township 9.

Belmont	97	N. $\frac{1}{2}$ & S. E. $\frac{1}{4}$; canceled ..	120	.....	120	
do	171	do		160	160	
Franklin	191	Ex S. E. $\frac{1}{4}$; canceled.....		120		
do	191	All; canceled			160	
do	225	Ex N. W. $\frac{1}{4}$; canceled		120	120	
do	246	do		200	200	

HAMILTON COUNTY.

OXBOW TRACT.

Wells.....	53	All in Wells; canceled			25	
------------	----	------------------------------	--	--	----	--

APPENDIX D—(Continued).

ULSTER COUNTY.

TOWN.	Lot.	DESCRIPTION.	ACRES ACQUIRED BY TAX SALE.			Other titles.
			1871.	1877.	1881.	
Hurley		HURLEY PATENTEE WOODS. Great Lot 9. S. E. Side of 2 $\frac{1}{2}$ a, b'd N. E. by Alvin G. Van Etten, S. E. by Hiram Cramer & S. W. by Doct Chetsey; redeemed	1 $\frac{1}{2}$			

The following lands were omitted from the list of lands belonging to the State, published in the First Annual Report of this Commission :

FULTON COUNTY

TOWN.	Lot.	DESCRIPTION.	ACRES ACQUIRED BY TAX SALE.			Other titles.
			1871.	1877.	1881.	
Stratford	88	JERSEYFIELD PATENT. Ali in Stratford, 368a., ex. 100a. N. E. cor. thereof	.....	263		
do	88	All in Stratford, 865a. ex. 100a., N. E. cor. thereof.	.....	.....	265	

HAMILTON COUNTY

OXBOW TRACT.

Lake Pleasant ..	53	All in Lake Pleasant	*154 $\frac{2}{100}$	
------------------	----	----------------------------	-------	-------	----------------------	--

* Instead of 130 as given in first report, page 278.

APPENDIX E.

List of Actions pending March 1, 1887.

WILLIAM W. DEWEY, Attorney, Lowville, Lewis County, N. Y.

SUPREME COURT — ONEIDA COUNTY.

THE PEOPLE, ETC.,

against

ANDREW SPERL.

Action commenced March 11, 1886 ; cause of action fifty penalties ; order of arrest ; Sperl is leader of a gang ; trespass on lot No. 38, Jerseyfield Patent, Herkimer county, from December 1, 1885, to March 10, 1886. Arrested October 26, 1886, by sheriff of Herkimer county ; Gave bail for appearance ; Trial, April circuit, 1887.

SUPREME COURT — ONEIDA COUNTY.

THE PEOPLE, Etc

against

FRANK FIRTH.

Action commenced March 11, 1886 ; cause of action fifty penalties ; order of arrest served ; defendant under \$500 bond ; same time as above ; good evidence ; trespass on lot No. 38, Jerseyfield Patent, Herkimer county over November circuit, 1886, to be tried April circuit, 1887

PREME COURT — ONEIDA COUNTY.

THE PEOPLE, ETC.,

against

CHARLES BOWLEY, CHARLES PAU-
LEY, CHARLES NEAR AND SEYMOUR
METZ.

Action commenced March 11, 1886 ; action for twenty-five penalties ; trespass from September, 1885, to March 10, 1886, both inclusive ; lot 297, Oxbow tract, Hamilton county ; good evidence ; cause on June and November calendar and over terms.

SUPREME COURT — ONEIDA COUNTY.

THE PEOPLE, Etc.,
against
 JAMES HODGE.

Action commenced March 11, 1886; action for twenty penalties; trespass January, February and March, 1882; cherry logs; amended to action for triple damages; to be tried April circuit; lot 39 Jerseyfield Patent; good evidence.

SUPREME COURT — ONEIDA COUNTY.

THE PEOPLE, Etc.,
against
 GEORGE TURNER.

Action commenced March 16, 1886; action for fifty penalties; Winter of 1883 and 1884; lot 82, Jerseyfield Patent; evidence good; amended to action for triple damages; to be tried April Circuit.

SUPREME COURT — ONEIDA COUNTY.

THE PEOPLE, Etc.,
against
 HENRY COOL, SAMUEL WELESTER,
 HENRY JONES (*alias* COOL AND ORVILLE
 COOL.)

Action commenced March 22, 1886; Action for 266 penalties; order of arrest; defendants under bail; trespass September 1, 1886, to March 19, 1886; Jerseyfield Patent, lot 34, all in Stratford, Fulton county, N. Y.; 130 acres; good evidence; over June and November Circuit.

SUPREME COURT — ONEIDA COUNTY.

THE PEOPLE, Etc.,
against
 JOSEPH RAND.

Action commenced March 22, 1886; action for eighty penalties; trespass September 1, 1885, to March 10, 1886; lot 82, Jerseyfield

Patent; sheriff unable to find defendant, one of the leaders of timber thieves; evidence first-class; summons served by publication; G. S. Mereness, Referee.

SUPREME COURT — ONEIDA COUNTY.

<p>THE PEOPLE, Etc., <i>against</i> GEORGE V. KASE.</p>	}
---	---

Action commenced March 22, 1886; action for twenty penalties; trespass from August, 1885, to March, 1886, both inclusive; order of arrest; to be tried April Circuit.

SUPREME COURT — ONEIDA COUNTY.

<p>THE PEOPLE, ETC., <i>against</i> GILBERT BRADT.</p>	}
--	---

Action commenced April 7, 1886; Action for fifteen penalties; trespass on lot 7, subdivision 2, of Lott & Low's Patent, in Fulton county, in November and December, 1885; Over June and November Circuit.

SUPREME COURT — HERKIMER COUNT

<p>THE PEOPLE, ETC., <i>against</i> LEWIS DALEY, JR.,</p>	}
---	---

Action commenced April 26, 1886; action for fifty-one penalties; trespass on lot 35 of south-west quarter, Jerseyfield Patent; defendant arrested; gave bail; to be tried in April Circuit.

SUPREME COURT — HERKIMER COUNTY.

 THE PEOPLE, Etc.,

against

 DAVID JAMES, JR., AND JOSEPH
YATES.

Action commenced April 26, 1886: action for one hundred penalties; trespass on lot 3, Jerseyfield Patent: west half, except 50 acres north-east corner and 17½ acres south end, 30 chains wide north and south, and 58 chains long east and west; defendant arrested; gave bail; trial in April Circuit, 1887.

SUPREME COURT — HERKIMER COUNTY.

 THE PEOPLE, Etc.,

against

 BURT B. WENDOVER, WILLIAM KASE,
GEORGE NEWMAN AND BENJAMIN
WENDOVER.

Action commenced April 26, 1886; action for one hundred and forty-seven penalties; trespass on lot 38, Jerseyfield Patent; defendants, William Kase, Benjamin Wendover and George Newman gave bail; to be tried April Circuit.

SUPREME COURT — HERKIMER COUNTY.

 THE PEOPLE, Etc.,

against

 CHARLES BOYER, JR., AND WILLIAM
BOYER.

Action commenced April 26, 1886; action for fifteen penalties; trespass on lot 67, Jerseyfield Patent, except forty acres in the north-east corner; defendants arrested; gave bail; to be tried in Johnstown Circuit.

SUPREME COURT — FULTON COUNTY.

THE PEOPLE, ETC., <i>against</i> JAMES EDICK.

Action commenced August 7, 1886; action for ninety-nine penalties; trespass on lots 292 and 293, Oxbow tract; to be tried in Johnston Circuit.

PETER S. PALMER, *Attorney, Plattsburgh, N. Y.*

SUPREME COURT — FRANKLIN COUNTY.

THE PEOPLE, ETC., <i>against</i> BENTON T. TURNER.
--

Trespass on lots 213 and 214, Township 9, Old Military Tract; answer general denial; noticed for trial at March (1887) Circuit, Franklin county.

CHARLES HUGHES, *Attorney, Sandy Hill.*

SUPREME COURT — ESSEX COUNTY.

THE PEOPLE, ETC., <i>against</i> LEMON THOMPSON.
--

Action commenced January 24, 1887; seven hundred penalties; trespass on lot 35; Richard's survey; township 27; Totten & Crossfield's purchase.

APPENDIX "F"

Receipts and Expenditures.

The act to establish a Forest Commission appropriated to its use the sum of..... \$15,000 00

There was also a supplemental appropriation May 12, 1886, to provide for deficiency in this department, of the sum of 5.000 00

Total \$20,000 00

On the 31st day of March, 1886. there was remaining out of this amount unexpended and unavailable, \$1,091 57

There was appropriated for the use of the Commission, May 18, 1886, for the fiscal year ending September 30, 1887, the sum of \$32,500 00

On the 31st of March, 1887, there was, out of that amount, remaining unexpended and available for the specific purposes, only, named in the act of appropriation, the sum of..... \$20,885 33

Of this apparently available amount a large part cannot be used by the Commission owing to the limitations of the appropriation act.

MONTHLY PAY-ROLL OF THE FOREST COMMISSION.

Abner L. Train, secretary	\$200 00
Samuel F. Garmon, warden	200 00
William F. Fox, assistant warden	166 66
Charles F. Carpenter, inspector.	125 00
John B. Locke, inspector	83 34
John Clohossy, forester	40 00
Robert Cline, forester	40 00
Allan Olmsted, forester	40 00
Archibald Muir, forester	40 00
Henry Bradley, forester	40 00
Michael Hogan, forester	40 00
Henry Studor, forester	40 00
Frank C. Parker, forester	40 00
Robert M. Kirk, forester	40 00
William Flynn, forester	40 00
David J. Wilson, forester	40 00
Russeli McCarthy, forester	40 00
Gershom Banker, forester	40 00
Lewis Lawton, forester	40 00
Charles A. Davis, forester	40 00

OFFICERS OF THE FOREST COMMISSION.

COMMISSIONERS.

Theodore B. Basselin..... Crogan, Lewis county
 Townsend Cox Glen Cove, Long Island.
 Sherman W. Knevals..... New York city.

The official post-office address of the Commissioners is Albany,
 N. Y.

SECRETARY.

Name.	Post-office address.
Abner L. Train	Albany, N. Y.

WARDEN.

Samuel F. Garmon Lowville, Lewis county.

ASSISTANT WARDEN.

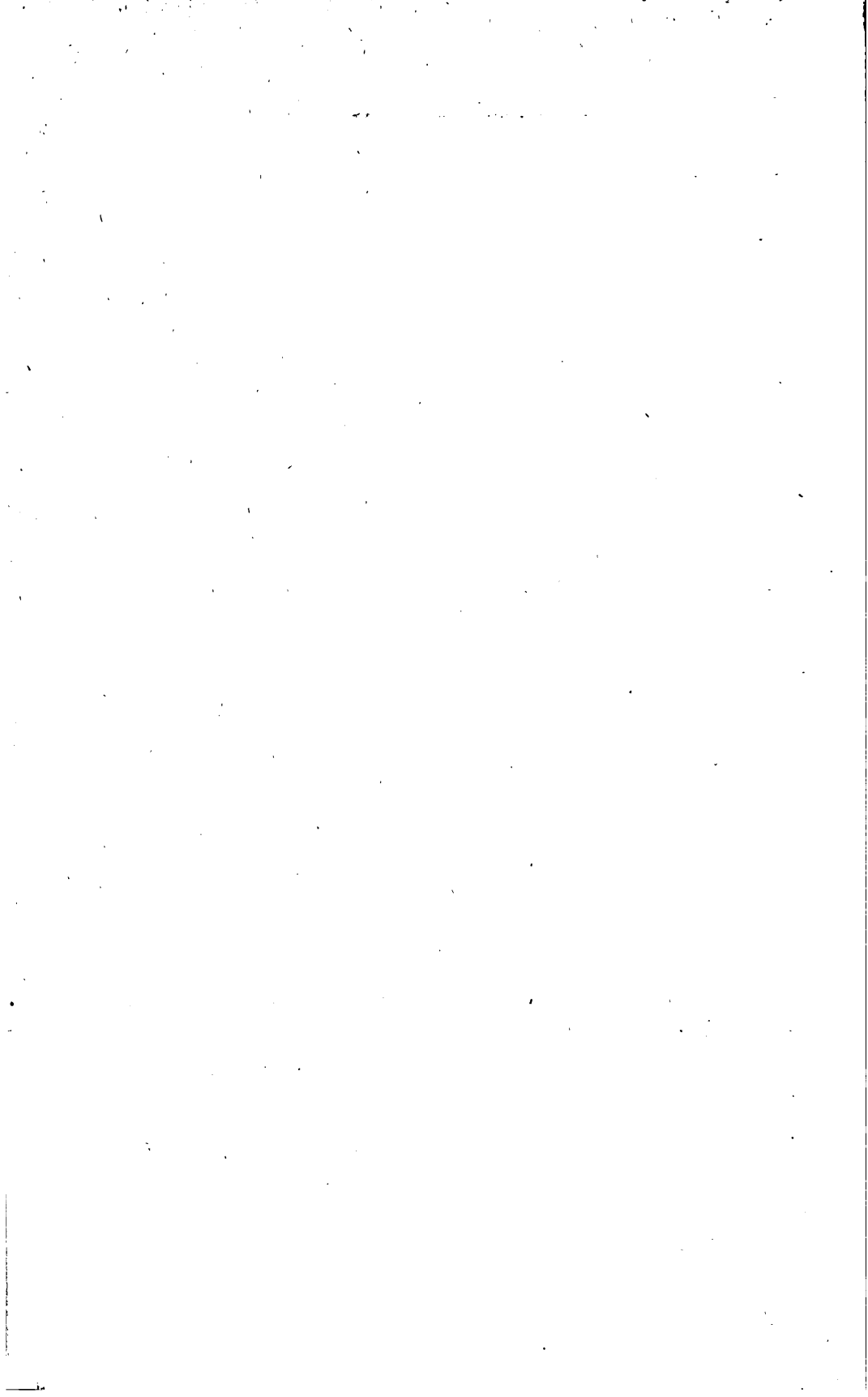
William F. Fox..... Albany, N. Y.

INSPECTORS.

Charles F. Carpenter..... Albany, N. Y.
 John B. Locke Albany, N. Y.

FORESTERS.

Gershom Banker..... Fonda, Montgomery county.
 Henry Bradley Olmstedville, Essex county.
 Robert Cline Croghan, Lewis county.
 John Clohossy..... Colton, St. Lawrence county.
 Charles A. Davis Holland Patent, Oneida county.
 William Flynn Shushan, Washington county.
 Michael Hogan Ellenville, Ulster county.
 Robert M. Kirk Sageville, Hamilton county.
 Lewis Lawton Gray, Herkimer county.
 Russell MacCarthy..... Care Forest Commission, Albany.
 Archibald Muir..... Fine, St. Lawrence county.
 Allen Olmsted..... Potsdam, St. Lawrence county.
 Frank C. Parker..... Keene Valley, Essex county.
 Henry Studor White Lake Corners, Oneida county.
 David J. Wilson..... Amboy Centre, Oswego county.



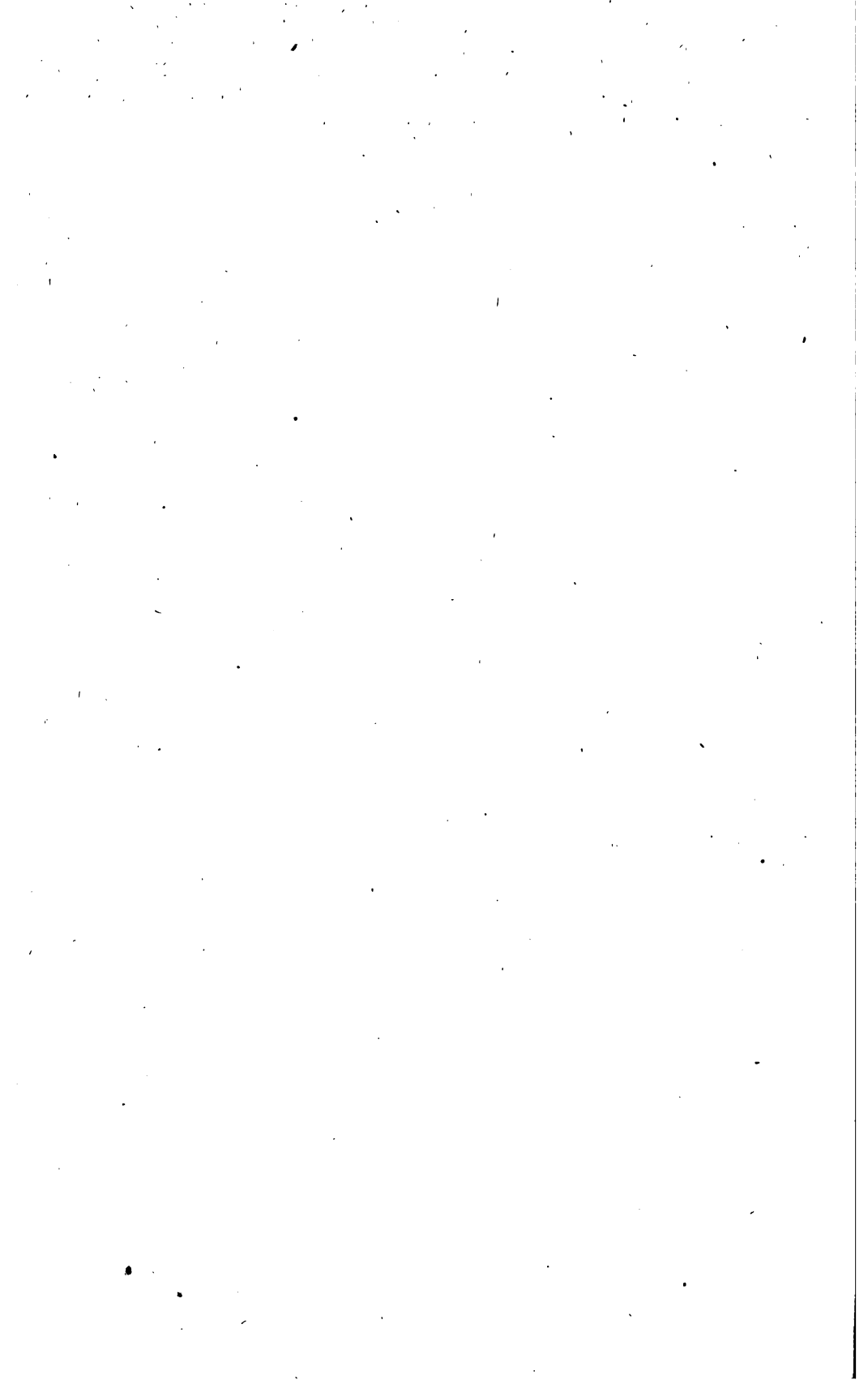
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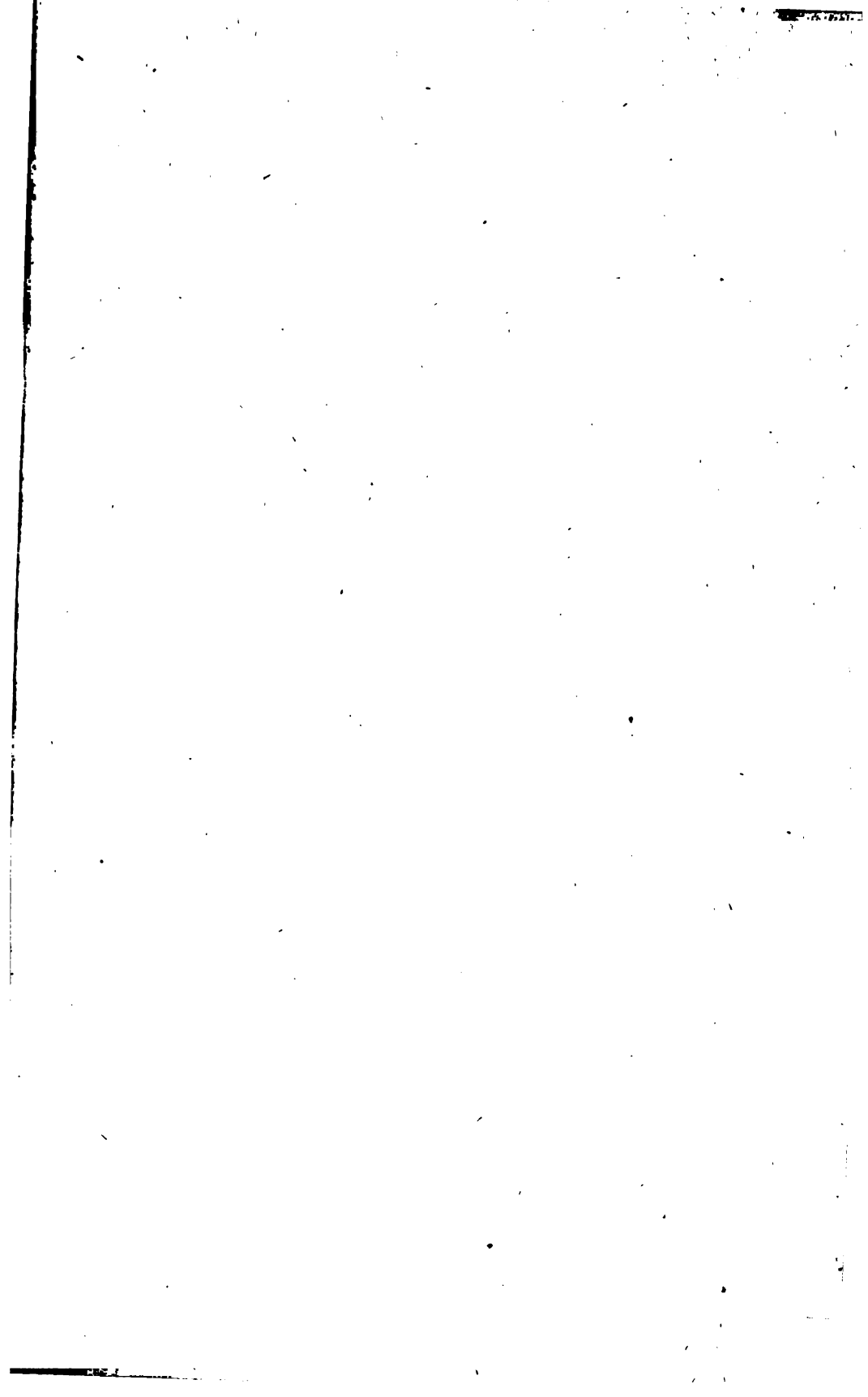
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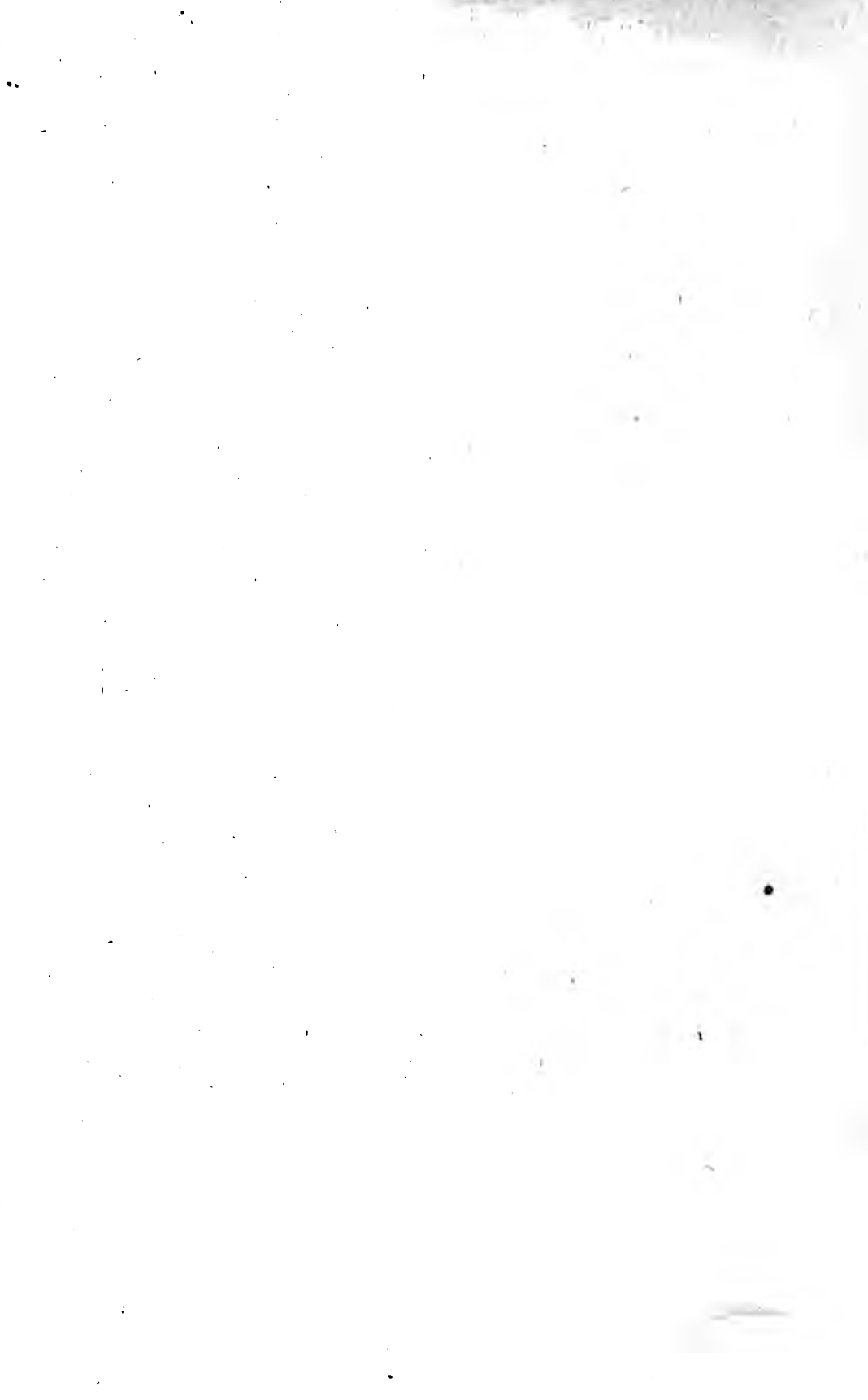
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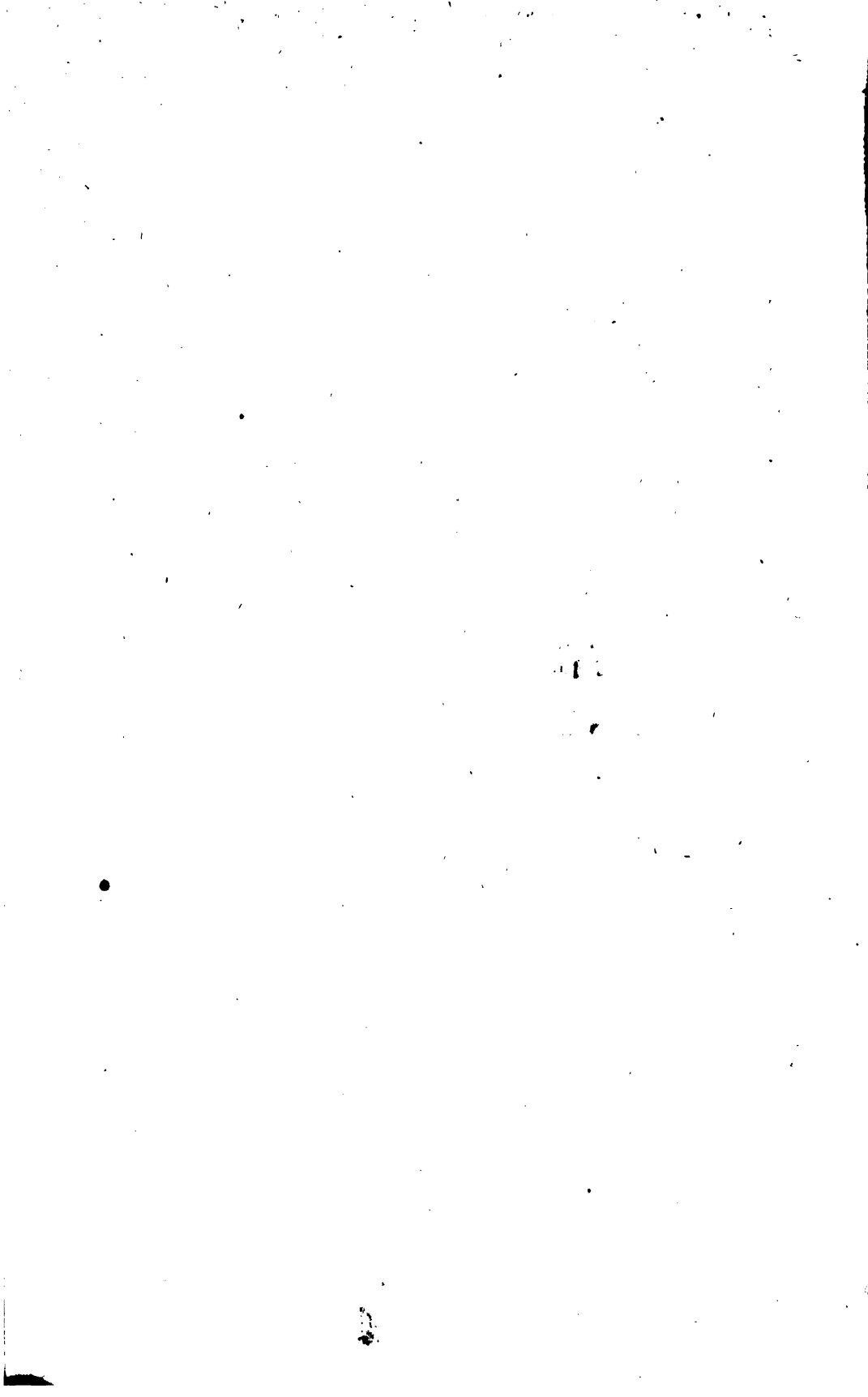
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